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GLASSIFICATION AND LEACHABILITY OF HAZARDOUS WASTES AND HAZARDOUS WASTE RESIDUES

R. A. C. PROJECT NO. 411C

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FINAL REPORT ON RAC PROJECT NO. 411C: GLASSIFICATION AND LEACHABILITY OF HAZARDOUS WASTES AND HAZARDOUS WASTE RESIDUES

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FINAL REPORT ON RAC PROJECT NO. 411C: GLASSIFICATION AND LEACHABILITY OF HAZARDOUS WASTES AND HAZARDOUS WASTE RESIDUES

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SUMMARY

This report describes work carried out under Ontario Ministry of the Environment Contract No. 411C, 'Glassification and Leachability of Hazardous Wastes and Hazardous Waste Residues.' The objective of the work was to make an initial assessment of the benefits, if any, to be obtained from incorporating hazardous wastes or hazardous waste residues into glassy wasteforms. The major benefit to be anticipated would be to reduce the rate at which heavy metal ions would be released into groundwater under conditions of land disposal.

A simulated waste has been made containing 14 heavy metals (approximately 1% wt. of each) and including those listed in Ontario Regulation 309, Schedule 4 (Leachate Quality Criteria). The waste has been calcined to 1400°C, with partial melting, to simulate an incinerator slag, and has also been incorporated into soda-lime glass wasteforms at levels of 10% and 40% by weight. Chemical analysis of the starting materials, the calcined waste, and the glassy wasteforms suggest that mercury and selenium, and some arsenic, silver, and cadmium are lost during the heating process of calcination, but that no additional volatile losses occur as a result of incorporation into a wasteform.

Leachate Extraction Procedure tests according to Regulation 309 showed that calcination to 1400°C or incorporation into a glassy wasteform gave leachate concentrations of the heavy metals of less than 10x Leachate

Quality Criteria, with the marginal exception of cadmium. In the case of cadmium, the reduction in leachate concentration was of the order of 3 to 4 orders of magnitude, compared to that obtained from the original waste. Serial leaching tests of monolithic wasteforms at 10°C, and at 22.°C, show that the majority of releases are below chemical detection limits, and in all cases the concentrations are less than 10x Leachate Quality Criteria. Tests with radioactively-spiked wasteforms suggests that the dissolution rate of the wasteforms was in the region of 1×10^{-08} $g/cm^2.d$. This is approximately one hundred times lower than the current U.S. standards for the immobilization of High-Level nuclear wastes.

It is recommended that further work should be conducted to optimize the wasteform composition for the immobilization of specific wastes. It is also recommended that the development of the technology of joule melting incineration be undertaken, as a means of simultaneously incinerating wastes and incorporating their residues into a durable wasteform. This technology has other potential advantages, including low capital cost, reduced gaseous emissions, and the ability to utilize dirty or contaminated glass scrap as a basis for the immobilizing medium.

1. INTRODUCTION

Hazardous wastes are those wastes which, due to their nature or quantity, are potentially hazardous to human health and or the environment and which require special disposal techniques to eliminate or reduce the hazard. The most recent estimate (1988) suggests that approximately 6.5 million tonnes of hazardous wastes are produced annually in Canada [1], or about 250 kg per person. Estimates made in 1982 suggested a production of approximately 2.8 million tonnes per year, of which the Province of Ontario contributed approximately 1.4 million tonnes [2,3].

A majority of hazardous wastes are disposed of in landfill sites. Depending on the specific waste, disposal might be placed directly into a dedicated site, or there may be pre-disposal treatments such as solidification in media such as bitumen or cement, physical/chemical treatment methods such as neutralization and precipitation, or incineration. Typically, the solid residues from these latter operations are then placed in a landfill, and the liquid residues discharged into a sewer, or injected into a deep well. The solid residues obtained from these operations, as well as directly from many manufacturing processes, are likely to be inorganic sludges, or the slags, ashes and dusts from incinerators, furnaces, and air-cleaning plants, and to contain concentrations of heavy metal ions.

When placed in landfills and subsequently exposed to the action of rain, runoff, or groundwater, it is possible for the heavy metal ions in the wastes to be mobilized, be transported from their disposal site in a leachate, and re-enter the biosphere. To prevent or minimize any such mobilization, the Ontario Ministry of the Environment is examining the possible benefits of incorporating hazardous wastes. or hazardous waste residues, into glassy wasteforms.

Incorporation of the waste into a glassy wasteform has several potential advantages. Firstly, it can agglomerate the waste and so reduce the surface area available for contact with the groundwater. Secondly, a wasteform can be designed to be durable under given conditions, so that the

rate of release from it can be lower than from the primary waste. Finally, if release is by the dissolution of a glassy wasteform, then all heavy metal ions incorporated in it will be released at the same rate, simplifying the description of disposal behaviour. As well as being durable, a wasteform might also be used to modify the chemistry of the disposal site, depressing the concentrations of waste ions in solution, or retarding the rate at which they would be transported from the site.

Schedule 4 of the Ontario Regulation 309 lists a number of heavy metals and defines the toxic levels of the leachate of these metals as one hundred times the Leachate Quality Criteria. The Leachate Quality Criteria are usually defined from the Ontario Drinking Water Objectives.

A waste may be classified as hazardous waste by testing it according to the Leachate Extraction Procedure described in the Ontario Regulation 309 (4). In the Leachate Extraction Procedure a granulated sample of waste is placed in contact with a pH 5 solution of acetic acid at a temperature between 20°C and 25°C for 24 hours, and the resulting concentrations of specified ions in solution measured. If the measured ion concentration is more than one hundred times the Leachate Quality Criteria (Schedule 4), the waste is classified as leachate toxic waste and consequently hazardous.

The objective of the work is to make an initial assessment of any benefits from incorporating hazardous wastes or hazardous waste residues into glassy wasteforms. The hazardous wastes or residues in question would contain heavy metal ions, and are likely to be inorganic sludges or solids derived from manufacturing processes or from a primary waste treatment, or to be the slags, ashes, or dusts from incinerators, furnaces, and air-cleaning plants.

Specifically, the objectives of the work to be performed under this contract are:

(a) To make a simulated waste composition containing all of the metals listed in Schedule 4, Regulation 309, and which would have the general characteristics of a process sludge or residue.

(b) To calcine the waste at several temperatures to simulate the production of an incinerator residue or slag, and determine the extent of loss of volatile metals.

(c) To incorporate the waste into a soda-lime glass composition, as a possible wasteform suitable for permanent land disposal.

(d) To subject the original waste composition, and the glass/waste wasteforms, to the Leachate Extraction Procedure specified in Regulation 309 to determine the final concentrations of the listed metals in solution.

(e) To repeat the Leachate Extraction Procedure at 10°C, as more representative of an in-ground temperature in Canada.

(f) To perform a long-term dissolution experiment at 10°C on wastes and wasteforms, to simulate extended release under conditions of in-ground disposal.

(g) Finally, based on the results obtained in this contract, to recommend any further work that may be desirable to develop a process for the safe permanent disposal of hazardous waste residues.

2. EXPERIMENTAL

2.1 Facilities

On the advice of the Radiation and Industrial Safety Branch at AECL Research, Whiteshell Laboratories, the simulated wastes and wasteforms under consideration were defined as being chemically hazardous, and subject to the same precautions regarding handling and ingestion as radioactive materials. A CM box furnace capable of operation to 1700°C was set up in a fumehood connected to the building air extraction system via a HEPA (High Efficiency Particle Absolute) filter. A Lauda RMS-20 immersion bath

operable in the range -15°C to +120°C was placed in a second fumehood and surrounded by a barrier of lead bricks. These two facilities, together with the existing Hot Cell and Warm Cell facilities at AECL Research allowed for the manufacture, treatment, and testing of both the inactive and radioactive experimental materials used in this work.

2.2 Simulated Waste Composition

A simulated waste composition, Table 2.1., loosely based on a bottom ash from a coal-fired generating station ([5], waste 6) was made by mixing together the appropriate quantities of kaolin, iron oxide, titanium dioxide, calcium carbonate, and sodium chloride. The chloride was added to simulate any residues that might remain from the treatment of a waste containing organic chlorides. To this mixture was added 1% wt. of a selection of the metals that might be anticipated in a hazardous waste, including those listed in Schedule 4, Regulation 309. The mixture was homogenized by ball-milling in alcohol, drying, and crushing through a 9.5 mm ASTM sieve.

TABLE 2.1

COMPOSITION OF SIMULATED WASTE

	wt. %		wt. %
Al_2O_3	23.0	Cd	1.0
Fe_2O_3	28.0	Co	1.0
SiO_2	27.0	Cr	1.0
CaO	4.0	Cu	1.0
TiO_2	1.0	Hg	1.0
NaCl	2.5	Ni	1.0
Ag	1.0	Pb	1.0
As	1.0	Se	1.0
B	1.0	U	1.0
Ba	1.0	Zn	1.0

2.3 Glass Composition

A soda-lime glass composition, Table 2.2., was made by dry-mixing together sodium carbonate, calcium carbonate, and -100 mesh silica sand. The chemical composition lies in the centre of the range of compositions for commercial soda-lime glasses [6]. A variant, of the same chemical composition, was made by mixing together 'M' grade sodium silicate liquid, calcium carbonate, and silica.

TABLE 2.2

BASE SODA-LIME GLASS COMPOSITION

	Mole	wt. %
Na_2O	0.18	13.82
CaO	0.17	11.80
SiO_2	1.00	74.38

2.4 Wasteforms

2.4.1 Simulated wastes

The raw simulated waste as made was a light red powder.

Portions of the simulated waste composition were heated for one hour in air at 700°C, 1100°C, and 1400°C, respectively, to simulate conditions in furnaces or incinerators of different efficiencies.

At 700°C the waste remained a red powder, although with some weight loss and a deepening in colour. At 1100°C the waste had sintered into a dark red friable solid. At 1400°C the waste had melted into a black glassy solid which had a metallic sheen. Foaming was observed in the

1400°C sample, probably as a result of the release of oxygen through the $Fe^{3+} \rightarrow Fe^{2+}$ transition at 1260°C.

Rectangular blocks were cut from the 1100°C and 1400°C samples of the calcined waste for use in subsequent experiments. The 700°C calcine, and the remainder of the 1100°C and 1400°C samples, were crushed and passed through a 9.5 mm ASTM sieve, to provide materials for the Leachate Extraction Procedure experiments.

2.4.2 Glassy wasteforms

Waste/glass compositions were made by mixing together the raw glass composition and either raw waste or waste calcined to 1400°C in the proportions of 90% glass/10% waste and 60% glass/40% waste, by weight. There were thus eight variants:

(a) wasteform, 90% glass/10% waste, made by mixing raw waste with dry glass constituents.
(b) wasteform, 90% glass/10% waste, made by mixing raw waste with glass constituents including sodium silicate.
(c) wasteform, 90% glass/10% waste, made by mixing calcined waste with dry glass constituents.
(d) wasteform, 90% glass/10% waste, made by mixing calcined waste with glass constituents including sodium silicate.
(e) wasteform, 60% glass/40% waste, made by mixing raw waste with dry glass constituents.
(f) wasteform, 60% glass/40% waste, made by mixing raw waste with glass constituents including sodium silicate.
(g) wasteform, 60% glass/40% waste, made by mixing calcined waste with dry glass constituents.
(h) wasteform, 60% glass/40% waste, made by mixing calcined waste with glass constituents including sodium silicate.

In addition, one 90/10 and one 60/40 composition were made from calcined waste and dry glass constituents, spiked with approximately 4×10^6 Bq/gram each of ^{137}Cs and ^{60}Co. (1 Bequerel (Bq) is one radioactive

disintegration per second).

These radioactive compositions were made to provide an alternative method of estimating the dissolution rates of the glassy waste forms, should those rates be so small that release into the leachant fell below chemical detection limits. The levels of radioactivity were chosen as a compromise between the need to maximize the activity released during dissolution, for ease of measurement, and the ability to run the experiments behind shielding in a fumehood, and sample the leachants manually, rather than conducting them remotely, in a Hot Cell. Cesium was chosen as a convenient isotope for measurement, and cobalt as one of the heavy metals of particular interest.

The mixtures were ground together in a mechanical mortar, melted for 1 hour at 1400°C in platinum crucibles. Foaming was observed in wasteforms that were made from raw waste. The wasteform glasses were crushed, remelted, cast into bars in a steel mould, and annealed to room temperature.

Glasses based on the 90/10 glass/waste compositions were a dark blue in colour, while the 60/40 compositions were black/brown.

Blocks approximately 1-cm cube for use in the long-term dissolution experiments were sawn from the bars using a slow-speed diamond saw, cleaned in an ultrasonic bath successively in petroleum ether, isopropanol, and acetone, and stored for use in subsequent experiments. The remainder of the glass was crushed, and passed through a 9.5 mm ASTM sieve, to provide materials for subsequent Leachate Extraction Procedure experiments.

2.5 Experimental Schedule

The wastes and wasteforms produced were subjected to chemical analysis, and then used as the experimental materials in a series of dissolution experiments.

The purpose of the chemical analysis was, first, to establish the actual composition of the materials and, second, to investigate the loss of volatile constituents from the wastes and wasteforms as a function of processing method, and of the presence or absence of sodium silicate.

The purpose of the dissolution experiments was to determine if the incorporation of the wastes into a wasteform would lead to any reduction in the release of heavy metals, compared to release from the wastes themselves, when exposed to the action of a leachant. The primary screening test used was the 'Leachant Extraction Procedure,' as defined in Ontario Regulation 309. This procedure is described for a temperature of 20 - 25°C, and an acetic acid (HAc) medium of pH 5. The extraction protocol was repeated at 10°C, as more typical of a year-round Canadian inground temperature, and at both temperatures using deionized water (DIW) as a leachant rather than acetic acid.

A second round of dissolution experiments was performed in which monolithic specimens were exposed for long periods to a leachant from which aliquots were withdrawn at regular intervals, and replaced with fresh solution. These experiments would simulate exposure to flowing groundwater. For the sake of comparison and continuity, the experiments were conducted in DIW and pH 5 HAc, at 10°C and at 22.5°C.

3. RESULTS - CHEMICAL ANALYSIS, AND VOLATILITY OF HEAVY METALS

3.1. Simulated Waste Compositions

(a) Raw Simulated Waste

Table 3.1(a) shows the anticipated analysis of the raw simulated waste, as calculated from the proportions of its constituents. The actual chemical analysis of two raw waste samples are shown, together with the estimated analytical accuracies. The agreement is considered to be satisfactory in all cases excepting those for boron and mercury, given that several of the ingredients (notably barium as barium carbonate) were added as 'Technical' grade.

The figures for boron are low throughout all of the analyses, and it remains unresolved as to whether this was an analytical problem, or whether there was an error in the initial weighings. It is possible that the low analytical figures for mercury, which was added as the nitrate, are due to volatility even at ambient temperatures (see also Section 4.2.(e)).

(b) Calcined wastes

Tables 3.1.(b) and 3.1.(c) show the anticipated and actual analyses of the simulated waste calcined at 700°C, 1100°C, and 1400°C in air. The schedule for the calcination was a rapid rise from ambient to temperature (~ 1 hour), followed by a 1 hour soak at the calcination temperature, followed by extraction from the furnace and a rapid cooling to ambient temperature.

At 700°C, there is still some loss on ignition, suggesting that the decomposition of hydrated salts and of carbonates is still not complete. Mercury is below detection limits, and it is presumed to have volatilized. At 1100°C and 1400°C, mercury is below detection limits, and is presumed to have volatilized, while selenium, silver, arsenic, cadmium, copper, and lead are showing some reduction in content. The higher values reported for these elements at 1400°C compared with 1100°C are probably genuine, and a consequence of the waste having vitrified quickly at 1400°C, trapping these elements, rather than their having the ability to continue to volatilize from a porous sinter during the 1 hour soak at the calcination temperature, as at 1100°C.

3.2 Soda-Lime Glass Compositions

Portions of the mixture of dry components were melted at 1400°C in order to provide samples from which to establish the melted glass composition. Table 3.2. gives the anticipated analysis. and the actual analysis of two samples. The composition lies within the anticipated limits.

3.3 Waste/Glass Wasteforms

(a) 90% glass/10% waste

Four different wasteforms were produced under this heading, using glass made from the dry raw components, and glass made with the soda and some of the silica being derived from sodium silicate solution, together with waste added as the raw powder, and as the 1400°C calcine.

Complete chemical analyses of these four materials are given in Table 3.3.(a). All of the major components of the compositions lie within the anticipated limits, with the exception of some unresolved discrepancies in the calcium figures in the 90 (sodium silicate)/10 (calcined waste) glass. For all of the glasses, mercury and selenium are below detection limits, and are presumed to have volatilized. Other heavy metals had been retained at least as efficiently as in the 1400°C calcine, and within the analytical uncertainties, there was nothing to choose between the four glasses in this respect.

(b) 60% glass/40% waste

Four different wasteforms were produced under this heading, using glass made from the dry raw components, and glass made with the soda and some of the silica being derived from sodium silicate solution, together with waste added as the raw powder, and as the 1400°C calcine.

Complete chemical analyses of these four materials are given in Table 3.3.(b). All of the major components of the compositions lie within the anticipated limits, with the exception of some unresolved discrepancies in the sodium and calcium figures in the 60/40 (raw waste) glasses prepared using sodium silicate. For all of the glasses, mercury and selenium are below detection limits, and are presumed to have volatilized. Other heavy metals had been retained at least as efficiently as in the 1400°C calcine, and within the analytical uncertainties, there was nothing to choose between the four glasses in this respect.

(c) Comparison between wasteforms made with raw and calcined wastes, and the effect of sodium silicate.

Comparison of the analyses for the glassy wasteforms produced using raw and calcined (1400°C) wastes indicated no obvious differences in the levels of heavy metals present. This was true for both the 90/10 and the 60/40 wasteforms. The wasteforms containing calcined waste, the waste had undergone three heating and melting cycles, compared to two in the wasteforms containing raw waste, and one for the 1400°C calcined waste. This suggests that, although some loss of volatile metals is inevitable in any stabilization process that involves heating, no unusual losses should occur during glassification.

The retention of a large proportion of such metals as selenium, silver, arsenic, cadmium, copper, and lead in the wasteforms made using raw waste suggests that (so far as these metals are concerned) glassification would be effective method for stabilizing furnace and air-cleaning dusts as well as ashes and slags. In the case of ashes and slags, no further loss of volatile metals should take place during the process of glassification.

Sodium silicate is available in bulk as a range of viscous, highly alkaline solutions in water, and could have benefits in hazardous waste management in terms of stabilizing or neutralizing wastes for interim storage prior to any final treatment. It was included in this investigation in order to determine if a prior mixing with a simulated furnace or air-cleaning dust would reduce the volatilization of heavy metals during subsequent glassification. Comparison of the analyses for heavy metals in the glassy wasteforms produced with and without sodium silicate suggested that sodium silicate was not effective in reducing losses of heavy metals through volatilization.

3.4. Radioactive Waste/Glass Wasteforms

Specimens of the 90/10 and 60/40 wasteforms were produced in the AECL Research Hot Cell facility, using the dry raw materials and the 1400°C calcined waste. Since previous experiments (described above) had indicated

that there was no significant compositional difference between wasteforms produced using raw waste or calcined waste, the calcined waste was chosen to avoid any possible problems with glass foaming under remote handling conditions. Before melting, the materials were spiked with ^{137}Cs and ^{60}Co, added as the nitrate solutions. 1-cm (nominal) cube specimens were prepared using the techniques described in Section 3.3., with the exception that preparation took place remotely, inside a shielded facility (Hot Cell).

These specimens were used in the long-term dissolution experiments described in Section 4.1.3.

4. RESULTS - LONG-TERM DISSOLUTION AND LEACHATE EXTRACTION PROCEDURE EXPERIMENTS

4.1. Long-Term Dissolution Experiments

Rectangular blocks of the glassy wasteforms, and of the 1100°C and 1400°C calcined wastes, were subjected to long-term dissolution tests at 10°C and at 22.5°C in both deionized water (DIW), and in DIW adjusted to pH 5 with acetic acid (HAc). The test temperature was 10°C from Day 1 to Day 103, after which it was increased to 22.5°C from Day 103 to Day 193. Test temperatures were maintained to ± 0.1°C by means of a circulating water-bath.

Within the accuracy of the experiment and of the analysis, no apparent difference had been found in the wasteform compositions made using raw waste or calcined waste. The long-term dissolution experiments were then conducted using specimens made using calcined waste. and two specimens were tested for each set of conditions.

The solution volume/specimen surface area ratio was 10:1, and the solution volumes approximately 60 mL in each case. 20 mL aliquots of solution for analysis were removed from the sample tubes once every 7 days, and replaced with fresh solution. The aliquots removed for analysis were

acidified with HNO_3.

Solution analyses are expressed in μg/mL (parts per million). In the following Tables, analyses are given for both specimens at each point. Analyses that are above detection limits appear in BOLD. For comparison, at the right of the Tables are the quoted analytical sensitivities, together with a figure that is ten times Leachate Quality Criteria, that is, the maximum solution concentration that would be acceptable under proposed legislation.

An analysis of the leachate blanks that were run with the dissolution experiments, and of the original deionized water, showed the presence of calcium, silicon, and zinc at levels of 1 ppm and less, with a magnitude and variability similar to those seen in the leachate samples. Thus, there was no evidence that these elements were being released from the wasteforms, and the analyses for these elements have been eliminated from the results.

4.1.1. Calcined wastes

(a) Release at 10°C

Tables 4.1.1(a).1 and 4.1.1(a).2, respectively, show the solution concentrations resulting from release from the 1100°C calcine in DIW and HAc at 10°C. Of the hazardous metal additions, boron, barium, cadmium, cobalt, copper, lead, and selenium were above detection limits at the end of the test period. The releases appear to be slightly higher from the specimens leaching in HAc. Copper and selenium appear to have been extracted preferentially.

Tables 4.1.1(a).3 and 4.1.1(a).4, respectively, show the solution concentrations resulting from release from the 1400°C calcine in DIW and HAc at 10°C. Of the hazardous metal additions, boron, copper, and lead are above detection limits. The releases appear to be lower than with the 1100°C calcine and, since the elemental contents are generally higher than in the 1100°C calcine (Section 3.1(b)), the observation is that the

hazardous ions are more efficiently immobilized in the 1400°C calcine, than in the 1100°C calcine.

(b) Release at 22.5°C

Tables 4.1.1(b).1 and 4.1.1(b).2, respectively, show the solution concentrations resulting from release from the 1100°C calcine in DIW and HAc at 22.5°C. Of the hazardous metal additions, barium, cadmium, cobalt, copper, lead, and selenium were above detection limits during the test period. There appears to be no particular pattern in the level of releases from the specimens leaching in DIW or HAc. Copper and selenium appear to have been extracted preferentially.

Tables 4.1.1(b).3 and 4.1.1(b).4, respectively, show the solution concentrations resulting from release from the 1400°C calcine in DIW and HAc at 22.5°C. Of the hazardous metal additions, barium, cadmium, and copper are above detection limits. The releases appear to be lower in DIW than in HAc, and generally lower than with the 1100°C calcine.

4.1.2. Glassy wasteforms

(a) Release at 10°C

Tables 4.1.2(a).1 - 4.1.2(a).4 show the solution concentrations resulting from release from the 90% glass/10% calcined waste compositions in DIW and HAc. Both the wasteforms prepared using the dry glass ingredients, and using sodium silicate, are included. For the heavy metals, boron, cobalt, and lead show occasional releases, with the majority lying between the detection limit and twice the detection limit. There is no obvious pattern in these releases.

Tables 4.1.2(a).5 - 4.1.2(a).8 show the solution concentrations resulting from release from the 60% glass/40% calcined waste compositions Boron, cobalt, and lead show occasional releases, the majority lying between the detection limit and twice the detection limit. These releases appear to be of the same order as those from the 90/10 wasteform, but again

there is no obvious pattern to them.

(b) Release at 22.5°C

Tables 4.1.2(b).1 - 4.1.2(b).4 show the solution concentrations resulting from release from the 90% glass/10% calcined waste wasteforms Barium and lead show occasional releases, with the majority lying between the detection limit and twice the detection limit.

Tables 4.1.2(b).5 - 4.1.2(b).8 show the solution concentrations resulting from release from the 60% glass/40% calcined waste wasteforms. Barium, copper, and lead each show one release above the detection limit.

Since, with very few exceptions, release from the glassy wasteforms did not exceed detection limits, it was not possible to form any estimate of the release behaviour of the glasses. Consequently, these experiments were terminated shortly after Day 180.

4.1.3. Radioactive wasteforms

Following the termination of the long-term dissolution tests monitored by chemical analysis of the leachants, release tests were continued at 10°C, using quadruplicated specimens of the 90/10 and 60/40 wasteforms spiked with ^{137}Cs and ^{60}Co. Table 4.1.3.1 lists the activities and dimensions of the specimens used.

As before, 20 ml aliquots of leachant were removed and replaced by fresh solution, but in this instance, the aliquots were counted for ^{137}Cs and ^{60}Co activity. Tables 4.1.3.2 and 4.1.3.3 show the data to Day 195 for the 90/10 wasteform in DIW and HAc respectively. and Tables 4.1.3.4 and 4.1.3.5 similar data for the 60/40 wasteform.

After sampling on Day 195, the temperature of the water bath was increased to 22.5°C, and the experiment continued until Day 381. Tables 4.1.3.6 - 4.1.3.9 list the data for this period.

Considerable difficulty was experienced in the interpretation of these experiments. The radioactive releases into the leachant were at the lower limit for reliable counting, resulting in many cases in a report of 'Not Detected,' or otherwise in a count with a standard error in the range of 50 - 100%.

By contrast, there were also some very high apparent releases in individual samples, particularly associated with the 90/10 wasteform. If these high apparent releases were associated with material in solution, then the high readings would be expected to continue through into subsequent samples. This was not the case. In one case, (Table 4.1.3.3, Day 79), a small particle of glass could be seen in the leachant sample. It was concluded, therefore, that these individual high readings were 'fliers,' associated with small particles of glass drawn into the sampling pipette, and were not indicative of release into solution.

Secondly, within the standard error of the results, no difference could be distinguished between the levels of release into the DIW and HAc leachants, between the experiments conducted at 10°C and 22.5°C, or between the 90/10 and 60/40 wasteforms.

Thirdly, although the results showed a rough parity between the releases of ^{137}Cs and the releases of ^{60}Co, other experiments, which were not part of the present contract, have indicated that there are some unresolved problems in counting ^{60}Co reliably at the observed levels. It was decided, therefore, to exclude the ^{60}Co readings from any interpretation of the results.

Figure 4.1.3.1 shows a plot of the combined ^{137}Cs release data for the two leachants, the two temperatures, and the two wasteforms. (In this plot, all readings in excess of 30 Bq have been assumed to be fliers, and excluded). The general trend of the data suggest a high initial rate of release, falling over time to a constant level. This behaviour is typical of the dissolution of a glass, and has been discussed elsewhere, [10, 11].

In the steady state, the activity extracted from the experiment by the action of sampling will be balanced by the release of activity into solution from the waste form. A hyperbolic fit, of the form $y = A + B/x + C/x^2$, to the whole of the data shown in Figure 4.1.3.1 suggested a mean steady state release of 1.12 Bq per 10-day sampling period.

From Table 4.1.3.1, the mean surface area and the specific ^{137}Cs activity of the samples were 3.63 cm^2 and 2.57×10^6 Bq/g respectively. The corresponding mean dissolution rate can be calculated as follows:

Mean activity release per sampling period	= 1.12 Bq
Mean specific activity	= 2.57×10^6 Bq/g
Mean mass release per sampling period	= 4.36×10^{-7} g
Mean specimen surface area	= 3.63 cm^2
Mean mass release per unit area per period	= 1.2×10^{-7} g/cm^2
Mean dissolution rate	= 1.2×10^{-8} g/cm^2.day

This dissolution rate is probably an overestimate, since all of the releases small enough to be reported as 'Not Detected' have been excluded.

4.2 Leachate Extraction Procedure Testing

Experiments conforming to the Regulation 309 Leachate Extraction Procedure were performed on duplicated samples of six materials, at two temperatures, and in two leaching media. The materials used were:

- raw waste
- waste calcined at 1400°C
- 60/40 wasteform, made from dry glass constituents together with calcined waste.
- 60/40 wasteform, made from raw waste. and glass forming constituents including sodium silicate.
- 90/10 wasteform, made from dry glass constituents, and calcined waste.
- 90/10 wasteform, made from raw waste, and glass forming constituents including sodium silicate.

The extraction temperatures used were 22.5°C, as prescribed in the Regulation 309 procedure, and 10°C, as representative of a Canadian in-ground temperature.

The leaching media used were a pH 5 solution of acetic acid in water (HAc), as prescribed in the Regulation 309 procedure, and deionized water (DIW).

(a) Extraction at 10°C

Experiments following the Regulation 309 Leachate Extraction Procedure were conducted at 10°C. Analytical results for the leachates from duplicated experiments are shown in Table 4.2.(a).

(b) Extraction at 22.5°C

Leachate Extraction Procedure experiments were conducted at 22.5°C, according to Ontario Regulation 309. Analytical results for the leachates from duplicated experiments are shown in Table 4.2(b).

(c) Extraction in DIW at 10°C

Experiments following the Regulation 309 Leachate Extraction Procedure, but using DIW instead of HAc, were conducted at 10°C. Analytical results for the leachates from duplicated experiments are shown in Table 4.2.(c).

(d) Extraction in DIW at 22.5°C

Experiments following the Regulation 309 Leachate Extraction Procedure, but using DIW instead of HAc, were conducted at 22.5°C. Analytical results for the leachates from duplicated experiments are shown in Table 4.2(d).

Examination of the data in Tables 4.2(a) to 4.2(d) suggests:

(1) That there are no significant differences in the resulting leachant compositions when acetic acid solution (HAc) or DIW are used as the leachants.

(2) That the concentrations of heavy metals in the leachate appear to be slightly lower in experiments conducted at 10°C than in experiments conducted at 22.5°C.

In the case of the raw waste, the heavy metals were added to the waste composition either as oxides, carbonates, or nitrates, to give an elemental content of approximately 1% by weight in the waste. If the metals had all entered and remained in solution during the extraction procedure, each would show a solution concentration of approximately 500 ug/ml. However, the chemistry of the waste composition as a whole is likely to be quite complex, limiting or hindering the solution of some elements.

Under the particular conditions of the extraction procedures, the most soluble elements appear to be arsenic, barium, cadmium, mercury, and zinc, with leachate solution concentrations in the range 200 - 450 ug/ml. The concentrations of arsenic, barium, cadmium, copper, mercury and selenium in the leachate are in excess of the Leachate Toxic Criteria. The least soluble elements appear to be chromium, cobalt, lead, nickel, silver, and uranium, with leachate concentrations in the range 0 - 15 ug/ml. For all of the heavy metals, the leachant concentrations did not increase if the leachate extraction procedure was prolonged beyond the specified 24 hours to 7 days (see Section 4.2.1, Table 4.2.1), suggesting that some sort of solubility limit had been reached. The leachate concentrations of a few metals, notably boron, cadmium, copper, and mercury, appeared to have fallen when the extraction procedure was extended from 24 hours to 7 days, suggesting that some reprecipitation reactions might be taking place.

Calcination of the waste at 1400°C (which resulted in a partial melting of the waste), or incorporation of the waste into a glassy wasteform, markedly reduced the concentrations of heavy metals found in the extraction leachate, when compared to those from the raw waste. The low values for arsenic, mercury, and selenium are undoubtedly due to their

having been volatilized during the calcination.

Previous chemical analysis of the calcines and glassy waste forms (Tables 3.1.1, 3.3) indicated that cadmium was not lost during processing, and remained in the calcines and wasteforms at the anticipated levels. Using cadmium as the indicator, calcination or glassification of the waste resulted in the following (average) concentrations in the extraction leachates;

Raw waste:	223 ug/ml
1400 calcine:	.073 ug/ml
60/40 wasteform:	.051 ug/ml
90/10 wasteform:	.016 ug/ml

Thus, the action of glassification reduced the concentration of cadmium found in an extraction leachate by 3 - 4 orders of magnitude. The reductions observed for other heavy metals were not so large, but this appeared to be a function of the initial low levels observed in leachates from the raw waste, rather than any elevated levels observed in leachates from the glassified wastes.

4.2.1 Extraction over longer timescales

The average ratio of the cadmium concentrations in the extraction leachates (above) for the 60/40 and 90/10 wasteforms was approximately 3.2, while the average ratio of cadmium in the wasteforms themselves was 3.7. This similarity raised the possibility that release from the glassy wasteforms might be limited by the rate of dissolution of the wasteform, rather than by any solubility effects in the leachate.

A Leachate Extraction Procedure experiment using a 60/40 wasteform was extended to a total of 52 days. Table 4.2.1 shows the concentrations of heavy metals in the leachate at 24 hours, 7 days, and 52 days. It can be seen that the concentrations of those heavy metals that were above the detection limit increased over the 52 days, supporting the possibility that, for the glassy wasteforms, release might be limited by

the rate of dissolution of the wasteform. Since the surface area of the waste form was not known, no estimate of the dissolution rate was possible.

5. SUMMARY, DISCUSSION AND CONCLUSIONS

5.1 Rationale

Under the terms of Ontario Ministry of the Environment Research Contract No. 411C, a simulated hazardous waste containing heavy metals has been produced, and its properties observed and measured both alone, and when incorporated into a glassy wasteform.

Currently, hazardous wastes containing heavy metals are placed in secured landfills.
When exposed to the action of rain, runoff, or groundwater, it is possible for the heavy metal ions in the waste to be mobilized, be transported from the disposal site by the groundwater, and re-enter the biosphere.

The object of the work performed under this contract was to make an initial assessment of the benefits that might be obtained from incorporating hazardous wastes or hazardous waste residues into glassy wasteforms, with the ultimate aim of delisting. The hazardous wastes or residues in question would contain heavy metal ions, and are likely to be inorganic sludges or solids derived from manufacturing or waste treatment processes, or the dusts, ashes, and slags from furnaces, incinerators, or air-cleaning facilities.

This work addressed the following Research Needs [7]:

LS02 - Methods for solidification and/or encapsulation.
LS04 - Ultimate fate of wastes and waste byproducts.
LS09 - Serial leaching and its effects.
LS12 - Attenuation of leachate in groundwater.

and may also impact on:

LS03 - Technology for destruction and disposal of municipal and industrial wastes.

LS08 - Innovative re-use of waste materials.

5.2 Summary of Experimental Work and Results

A simulated waste composition was based on that of a bottom ash from a coal-fired generating station, and contained significant quantities of alumina, iron, and silica. It also contained approximately 1% wt. each of a selection of the metals that might be anticipated in a hazardous waste, including those listed in Schedule 4, Ontario Regulation 309.

As the glassifier, a soda-lime glass composition was chosen from the centre of the compositional range used in the commercial manufacture of container glass. This would simulate the use of scrap glass or cullet as the glassifier.

The waste was heated in air at 700°C, 1100°C, and 1400°C to simulate several levels of thermal treatment. It was found that mercury was lost from the waste very rapidly, possibly even at ambient temperatures, while selenium, silver, arsenic, cadmium, copper, and lead all showed some reduction in content on heating. At 1400°C, the waste had partially melted to form a vitreous slag.

The 1400°C calcine appeared to retain a higher proportion of the hazardous metals than did the 1100°C calcine. The observed behaviour is consistent with the metals being retained more efficiently in the glassy material maintained at 1400°C than in the porous sinter at 1100°C. This argues that any hazardous waste should be transformed into a glassy residue as quickly as possible for the efficient retention of these metals.

Glassy wasteforms were produced containing 10% wt. and 40% wt. of both the raw and the 1400°C calcined waste. The glass compositions were produced both from dry ingredients, and using sodium silicate solutions. The glassy wasteforms both melted readily at 1400°C, and were respectively dark blue and black/brown in colour.

Comparison of the chemical analyses of the wastes, and of the glassy wasteforms made from both raw and calcined waste indicated that no further loss of volatile metals took place as the result of glassification. Comparison of the chemical analyses of wasteforms made with and without the use of sodium silicate indicated that premixing of the wastes with sodium silicate prior to glassification was not effective in further reducing the loss of volatile metals.

Samples of the raw waste, waste calcined at 1400°C, and the glassy wasteforms were tested according to the Leachate Extraction Procedure, as defined in Ontario Regulation 309. The leachate from the raw waste was found to be well in excess of the Ontario Leachate Toxic Criteria for the specified metals. Leachates from the 1400°C calcined waste, and from all of the wasteforms all lay within the Leachate Quality Criteria. The reduction in the concentrations of heavy metals, compared to leachate from the raw waste, lay between 3 and 4 orders of magnitude.

Further tests were conducted following the Leachate Extraction Procedure protocol, but using different temperatures, leaching media, and times.

Tests were carried out at 10°C (as opposed to 20 - 25°C for the Leachate Extraction Procedure), as representative of an average year-round inground temperature. Concentrations of heavy metals in the leachate appeared to be slightly, but not significantly, lower than at 20 - 25°C.

Tests were carried out in deionized water (DIW) as an alternative to the pH 5 acetic acid solution (HAc) specified for the Leachate Extraction Procedure. Concentrations of heavy metals in the leachate appeared to be slightly, but not significantly, lower in DIW than in HAc.

Leachate Extraction Procedure tests were extended beyond the specified 24 hours, to a maximum of 52 days. For the glassy wasteforms, the concentrations of heavy metals in the leachates increased with time, suggesting that release from the wasteforms was limited by wasteform dissolution rate rather than by any other mechanism.

Long-term serial leaching tests were conducted on the 1100°C and 1400°C calcines, and on the glassy wasteforms. The 1100°C calcine showed releases in excess of Leachate Quality Criteria for cadmium and selenium. The 1400°C calcine, and the glassy wasteforms, showed very few releases above analytical detection limits, to the extent that the analyses were not useful in estimating release behaviour.

Long-term serial leaching tests were conducted on glassy wasteform compositions spiked with ^{137}Cs and ^{60}Co radioactive tracers. Again, the levels of release are low, but it is possible to estimate a dissolution rate of approximately 1×10^{-8} g/cm^2.d for the glassy wasteforms, and a correspondingly lower pro-rata rate of release of the heavy metals. This rate of release is approximately one hundred times less than the requirement for the immobilization of high-level nuclear wastes in the USA [8]. (No standards have yet been defined in Canada)

5.3 Conclusions and Recommendations

On the basis of the preliminary investigation described above, glassification appears to be an effective method of immobilizing the non-volatile heavy metals that may be present in hazardous wastes or hazardous waste residues. In the particular systems investigated, the release of heavy metals during Leachate Extraction Procedure testing lay within the limits prescribed for the Ontario Leachate Toxic Criteria, while in serial leaching tests the dissolution rates of the glassy waste forms were lower than those prescribed under U.S. regulations for the immobilization of high-level nuclear reprocessing wastes.

Following this preliminary investigation, further work would appear to be desirable in the following areas:

(1) Optimization of the waste form composition. Both the waste and the waste form compositions used in the present investigation were chosen relatively arbitrarily and some optimization should be possible, particularly with respect to specific wastes.

(2) The identification or development of technology to glassify wastes. Current designs of furnaces and incinerators are not well adapted to the production of molten waste forms.

(3) The development of alternative methods of release testing for glassified wastes. The current work has demonstrated limitations in the use of both chemical and radioactive methods to track release from durable waste forms at potential disposal temperatures.

These three recommendations are discussed in more detail in Section 6.

6. RECOMMENDATIONS FOR FURTHER WORK

6.1 Optimization of Wasteform Composition

The wasteform compositions used in the above work resulted from relatively arbitrary choices of glass and wasteform compositions. It may be possible to develop wasteforms compositions that are very much more durable, where durability is defined in terms of the rate of release of heavy metal ions into solution.

Some glass compositions developed for the immobilization of high-level nuclear reprocessing wastes, particularly those developed at the Savannah River Laboratories (SRL), have proved to be very durable [9]. The durability appears to be conferred by the formation of a hydrated surface layer that impedes release into solution, rather than by any intrinsic properties of the glass itself, and the behaviour has been modelled theoretically [10].

The surface layer appears to be a mixture of hydrated oxides of silica, iron, and alumina, while the glass is a multi-component mixture with a melting point in the region of 1200°C. This is the type of composition that could readily lend itself to being made from glass scrap which through variability or contamination is not suitable for recycling,

together with small compositional adjustments by means of additives.

In the work reported in Section 4 of this report, it was found that both the wasteform containing 40% wt. of waste and the 1400°C calcined waste were effective in retaining heavy metal ions. This suggests that an effective wasteform could possibly contain more than 40% wt. waste (of this particular composition), to a limit imposed by the processability of the wasteform.

It is suggested that the next stage of the work could be a study of the properties of glassy wasteforms produced from mixtures of soda-lime glass, and simulated wastes. The independent variables would be the glass/waste ratio, the waste composition, and minor additives. The measured properties would be the viscosity of the wasteform melt, as an index of melting temperature and processability, and the release properties of the wasteform, measured both by the Leachate Extraction Procedure, and by a serial leaching test. It would probably be sufficient if the heavy metal contents of the wasteform were limited to ^{137}Cs and cadmium, as the active and inactive tracers, respectively.

6.2 Technology for the Glassification of Wastes

The incorporation of furnace or incinerator residues into a glassy wasteform involves a second process step, which can be accomplished by sintering or crucible melting in an intermittent furnace. However, it is useful to consider whether it would be more efficient to combine the primary waste treatment and the production of the glassy wasteform into a single process step. This argues for a slagging furnace or incinerator, or for the consideration of a joule melting incinerator [11] as a means for the treatment and destruction of hazardous wastes.

In a joule melting incinerator, Figure 6.2, a long pool of molten glass is heated by means of an electric current. Solid or liquid waste falls onto the surface of the pool and is decomposed. Solid materials are incorporated into the glass, while gaseous products pass down the melter, completing any combustion, and depositing dusts into the pool. As wastes,

together with glass making materials are added to the melter, glass containing the dissolved residues overflows into a container, providing the wasteform.

A secondary advantage of the joule melting incinerator is that no air is required for the combustion of fuel, so that off-gas volumes are minimized, and there is the possibility of tailoring the combustion atmosphere for specialized applications, such as pyrolysis, or the minimization of chloride emissions.

It is suggested that consideration is given to the construction of a demonstration of joule melting incineration for the treatment of hazardous wastes. This could be either on the pilot scale, as a demonstration of the technology, or on a laboratory scale, as a demonstration of the principle.

6.3 Development of Alternative Testing Methods

As reported in Section 4.2.1, a sample of a 60% glass/40% waste wasteform was subjected to a Leachate Extraction Procedure experiment extended to a total of 52 days. It was found that the concentrations of heavy metals in solution increased over that time period, suggesting that, with durable glassy wasteforms, release might be limited by the rate of dissolution of the wasteform.

In Sections 4.1.2 and 4.1.3, experiments aimed at measuring the rate of release of heavy metals from glassy wasteforms were described. These experiments relied on the extraction of aliquots of leachate from the system at regular intervals, and their replacement with fresh leachant. Using both chemical and radioactive tracer methods of analysis, it was found that the concentrations of the analyte in these aliquots were at or below detection limits.

It is suggested that an alternative method of release testing is investigated, in which the release of a radioactive tracer takes place into

a leachant contained in a sealed tube. The release is measured by counting of the activity found in a specified volume of the leachant at the top of the tube. This method allows the activity to accumulate over time, resulting in measurable levels for counting, and reduced counting errors. Both the apparatus to allow measurement, and the theoretical models to allow analysis of the data exist [10, 12].

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TABLE 3.1.1(a)
ANTICIPATED AND ACTUAL ANALYSES OF RAW WASTE COMPOSITIONS

Simulated Waste	Anticipated Analysis Expressed as Oxides (wt%)	Actual Analysis (wt%) (1)	(2)	
Al_2O_3	18.70	18.3	18.2	±0.9
Fe_2O_3	22.76	23.8	24.3	±1.2
SiO_2	22.76	24.7	24.7	±1.2
CaO	3.25	3.37	3.35	± .17
TiO_2	0.81	0.88	0.87	± .04
NaCl	2.03	2.15	2.17	± .11
Ag	0.87	0.92	0.93	± .05
As	1.07	1.00	1.05	± .05
B	2.62	0.49	0.46	± .03
Ba	0.91	0.80	0.79	± .04
Cd	0.93	0.96	0.98	± .05
Co	1.03	1.04	1.03	± .05
Cr	1.19	1.23	1.22	± .06
Cu	1.02	0.97	0.97	± .05
Hg	0.88	0.71	0.72	± .04
Ni	1.03	1.05	1.03	± .05
Pb	0.88	0.79	0.80	± .04
Se	1.15	1.06	1.08	± .06
U	0.92	0.94	0.94	± .11
Zn	1.01	1.00	1.00	± .05
LOI*	14.18	15.9	15.9	±0.8

* Loss on Ignition at 1000°C

TABLE 3.1.1(b)
ANTICIPATED AND ACTUAL ANALYSES OF
SIMULATED WASTE CALCINED AT 700°C

Simulated Waste	Anticipated Analysis Expressed as Oxides (wt%)	Actual Analysis (wt%)		
		(1)	(2)	
Al_2O_3	20.9	20.5	20.5	±1.0
Fe_2O_3	25.4	27.1	26.8	±1.4
SiO_2	25.4	27.4	27.6	±1.4
CaO	3.63	3.78	3.79	±0.19
TiO_2	0.91	0.98	0.99	± .05
NaCl	2.27	2.47	2.51	± .13
Ag	0.98	0.96	0.94	± .05
As	1.20	1.18	1.23	± .06
B	2.93	0.51	0.52	± .03
Ba	1.02	0.91	0.90	± .05
Cd	1.03	1.11	1.15	± .06
Co	1.16	1.16	1.17	± .06
Cr	1.32	1.37	1.38	± .07
Cu	1.13	1.11	1.11	± .06
Hg	0.98	< .02	< .02	± .02
Ni	1.15	1.17	1.18	± .06
Pb	0.98	0.89	0.92	± .05
Se	1.28	1.18	1.25	± .06
U	1.03	1.06	1.09	± .11
Zn	1.13	1.12	1.13	± .06
LOI	4.4	4.4	4.4	±0.5

TABLE 3.1.1(c)
ANTICIPATED AND ACTUAL ANALYSIS OF
SIMULATED WASTE CALCINED AT 1100°C AND 1400°C

Simulated Waste	Anticipated Analysis Expressed as Oxides (wt%)	Actual Analysis (wt%)				
		1100°C		1400°C		
Al_2O_3	21.79	21.5	21.6	21.3	21.6	±1.1
Fe_2O_3	26.52	28.0	28.9	27.7	27.5	±1.4
SiO_2	26.52	29.1	29.4	29.1	29.4	±1.5
CaO	3.79	4.0	4.0	3.9	4.0	±0.2
TiO_2	0.951	1.05	1.06	1.01	1.03	± .05
NaCl	2.37	2.60	2.53	2.60	2.62	± .13
Ag	1.02	0.55	0.53	0.70	0.75	± .05
As	1.25	.95	.97	1.22	1.22	± .06
B	3.05	.60	.61	.59	.56	± .03
Ba	1.06	0.92	0.93	0.90	0.92	± .05
Cd	1.08	.60	.61	.73	.72	± .04
Co	1.21	1.31	1.31	1.18	1.20	± .07
Cr	1.38	1.45	1.45	1.38	1.39	± .07
Cu	1.16	0.75	.77	1.12	1.14	± .06
Hg	1.02	$<$ .02	$<$ .02	$<$ .02	$<$ .02	± .02
Ni	1.20	1.23	1.23	1.17	1.20	± .06
Pb	1.02	0.8	0.76	0.80	0.80	± .04
Se	1.34	.015	.015	.008	.008	± .005
U	1.073	1.13	1.17	1.13	1.17	± .11
Zn	1.18	1.16	1.17	1.10	1.10	± .06
LOI	-	$<$ .10	$<$ .10	$<$ .10	$<$ .10	± .10

TABLE 3.2

ANTICIPATED AND ACTUAL ANALYSIS OF RAW AND MELTED GLASS COMPOSITIONS

	Anticipated Analysis Expressed as Oxides (wt%)	Actual Analysis (wt%)		
		(1)	(2)	
Raw Glass				
SiO_2	66.45	66.3	67.1	±1.3
CaO	6.97	7.1	7.2	±0.2
Na_2O	12.35	12.7	12.1	±0.3
LOI*	14.23	14.5	14.5	±0.1
Melted Glass				
SiO_2	77.48	76.4	77.8	±1.5
CaO	8.13	8.1	8.2	±0.2
Na_2O	14.41	14.3	14.4	±0.3
LOI	-	0.2	0.2	±0.1

TABLE 3.3(a)
ANTICIPATED AND ACTUAL ANALYSIS OF
90% GLASS/10% RAW WASTE COMPOSITIONS

Simulated Waste	Anticipated Analysis Expressed as Oxides (wt%)	Raw Waste Placed Directly in Glass (wt%)		Raw Waste Mixed With Sodium Silicate Before Adding to Glass (wt%)		
		(1)	(2)	(1)	(2)	
SiO_2	72.51	73	72	74	74	±4
CaO	7.70	7.5	7.4	7.7	7.6	±0.4
Na_2O	13.12	13.6	13.4	12.4	12.2	±0.6
Al_2O_3	2.12	2.12	2.09	2.12	2.11	±0.11
Fe_2O_3	2.59	2.73	2.66	2.72	2.77	±0.14
TiO_2	.092	0.133	0.135	0.112	0.126	±0.01
NaCl: with Na_2O						
Ag	0.10	0.08	.10	.11	.10	± .03
As	0.12	.096	.099	.111	.119	± .011
B	0.30	.05	.05	.06	.05	± .02
Ba	0.10	0.093	0.091	0.090	0.090	± .005
Cd	0.11	.086	.091	.105	.109	± .011
Co	0.12	0.123	0.118	0.121	0.121	± .006
Cr	0.14	0.128	0.125	0.132	0.132	± .007
Cu	0.12	0.129	0.105	0.114	0.116	± .01
Hg	0.10	$< .02$	$< .02$	$< .02$	$< .02$	± .02
Ni	0.12	0.116	0.119	0.120	0.126	± .01
Pb	0.10	0.92	.080	.091	.065	± .015
Se	0.13	$< .02$	$< .02$	$< .02$	$< .02$	± .02
U	0.11	.17	.20	.16	.19	± .07
Zn	0.11	.106	.105	.106	.106	± .005
LOI		.23	.23	.19	.19	± .05

TABLE 3.3(a) Continued
ANTICIPATED AND ACTUAL ANALYSIS OF
90% GLASS/10% CALCINED WASTE COMPOSITIONS

Simulated Waste	Anticipated Analysis Expressed as Oxides (wt%)	Calcined Waste Placed Directly in Glass (wt%)		Calcine Waste Mix With Sodium Silicate Before Adding to Glass (wt%)		
		(1)	(2)	(1)	(2)	
SiO_2	72.51	73	73	71	71	±4
CaO	7.70	7.6	7.6	10.9	10.9	±0.5
Na_2O	13.12	13.1	13.2	12.4	12.3	±0.6
Al_2O_3	2.12	2.33	2.33	2.24	2.22	± .12
Fe_2O_3	2.59	2.92	2.88	2.78	2.83	± .14
TiO_2	.092	.133	.138	.117	.108	± .01
NaCl: with Na_2O						
Ag	0.10	.10	.09	.08	.09	± .03
As	0.12	.114	.112	.107	.111	± .011
B	0.30	.06	.07	.06	.07	± .02
Ba	0.10	.097	.097	.093	.093	± .005
Cd	0.11	.069	.070	.064	.065	± .011
Co	0.12	.125	.125	.133	.135	± .007
Cr	0.14	.143	.140	.134	.134	± .007
Cu	0.12	.115	.114	.105	.106	± .01
Hg	0.10	< .02	< .02	< .02	< .02	± .02
Ni	0.12	.121	.123	.136	.134	± .01
Pb	0.10	.088	.096	.083	.087	± .015
Se	0.13	< .02	< .02	< .02	< .02	± .02
U	0.11	.18	.17	.19	.19	± .07
Zn	0.11	.115	.115	.111	.111	± .006

TABLE 3.3(b)
ANTICIPATED AND ACTUAL ANALYSIS OF
60% GLASS/40% RAW WASTE COMPOSITIONS

Simulated Waste	Anticipated Analysis Expressed as Oxides (wt%)	Raw Waste Placed Directly in Glass (wt%)		Raw Waste Mixed With Sodium Silicate Before Adding to Glass (wt%)		
		(1)	(2)	(1)	(2)	
SiO_2	57.4	60	60	56	56	±3
CaO	6.42	6.5	6.5	8.4	8.3	±0.4
Na_2O	9.22	8.9	9.0	10.3	10.4	±0.5
Al_2O_3	8.58	8.4	8.4	8.6	8.6	±0.4
Fe_2O_3	10.45	11.1	11.1	10.8	11.1	±0.6
TiO_2	0.37	0.42	0.43	0.41	0.41	±0.02
NaCl: with Na_2O						
Ag	0.40	0.33	0.32	0.35	0.33	± .04
As	0.49	.42	.41	.44	.50	± .03
B	1.20	.20	.23	.21	.19	± .02
Ba	0.42	0.365	0.367	0.360	0.361	± .018
Cd	0.43	.35	.35	.24	.24	± .02
Co	0.48	0.47	0.48	0.47	0.47	± .02
Cr	0.55	0.52	0.53	0.54	0.54	± .03
Cu	0.47	0.46	0.51	0.48	0.49	± .02
Hg	0.40	< .02	< .02	< .02	< .02	± .02
Ni	0.47	0.47	0.50	0.47	0.48	± .02
Pb	0.40	0.36	0.321	0.287	0.313	± .016
Se	0.53	< .02	< .02	< .02	< .02	± .02
U	0.42	0.52	0.51	0.54	0.53	± .08
Zn	0.46	0.43	0.44	0.43	0.44	± .02

TABLE 3.3(b) Continued
ANTICIPATED AND ACTUAL ANALYSIS OF
60% GLASS/40% CALCINED WASTE COMPOSITIONS

Simulated Waste	Anticipated Analysis Expressed as Oxides (wt%)	Calcined Waste Placed Directly in Glass (wt%)		Calcined Waste Mixed With Sodium Silicate Before Adding to Glass (wt%)		
		(1)	(2)	(1)	(2)	
SiO_2	57.4	58	58	59	59	±3
CaO	6.42	6.3	6.3	6.3	6.3	±0.3
Na_2O	9.22	8.8	8.7	9.2	9.2	±0.5
Al_2O_3	8.58	9.0	9.0	8.4	8.4	±0.5
Fe_2O_3	10.45	11.4	11.3	10.9	11.2	±0.6
TiO_2	0.37	0.44	0.45	0.42	0.41	±0.02
NaCl: with Na_2O						
Ag	0.40	0.36	0.30	0.35	0.37	± .04
As	0.49	.41	.42	.45	.43	± .02
B	1.20	.23	.23	.19	.19	± .02
Ba	0.42	0.376	0.376	0.359	0.361	± .018
Cd	0.43	.23	.24	.38	.38	± .02
Co	0.48	0.48	0.49	0.47	0.49	± .02
Cr	0.55	0.55	0.56	0.53	0.53	± .03
Cu	0.47	0.43	0.44	0.45	0.45	± .02
Hg	0.40	< .02	< .02	< .02	< .02	± .02
Ni	0.47	0.46	0.50	0.48	0.47	± .03
Pb	0.40	0.32	0.29	0.32	0.34	± .02
Se	0.53	< .02	< .02	< .02	< .02	± .02
U	0.42	0.51	0.52	0.50	0.48	± .08
Zn	0.46	0.44	0.40	0.45	0.43	± .02

TABLE 4.1.1(a).1
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
WASTE CALCINED AT 1100°C; 10°C; DIW

RW11-1 -2	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 7	DAY 14	DAY 21	DAY 28	DAY 35		
Si	.12 .04	.12 .08	.14 .13	.110 .10	.11 .10	±.02	
Ca	.182±.009 .039±.002	.264±.013 .140±.007	.266±.013 .239±.012	.165±.008 .143±.007	.139±.008 .191±.01	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	<.01	<.01	<.01	<.01	<.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	.12 .11	.09 .07	<.07	<.07	<.07	±.07	500
Ba	.009 <.004	<.004	<.004	.018 .016	.017 .016	±.004	100
Cd	<.01	.023 <.01	.067 .034	.063 .049	.072 .016	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	<.02	<.02	.11 .05	.15 .09	.20 .16	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	<.03	<.03	.04 <.03	<.03	<.03 .06	±.03	5
Se	.88 .39	.80 .84	.61 .96	.36 .64	.23 .57	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	<.006	.008 .011	.009 .012	.007 .007	.006 .011	±.006	

TABLE 4.1.1(a).1 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
WASTE CALCINED AT 1100°C; 10°C; DIW

RW11-1 -2	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 42	DAY 49	DAY 56	DAY 64	DAY 70		
Si	.09±.02 .07±.02	.1 ±.02 .09±.02	.07±.02 .06±.02	.09±.02 .05±.02	.07±.02 .04±.02	±.02	
Ca	.085±.004 .079±.004	.124±.006 .117±.006	.098±.005 .105±.005	.204±.01 .109±.005	.182±.01 .211±.011	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	<.01	<.01	<.01	<.01	<.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	<.07	<.07	<.07	<.07	<.07	±.07	500
Ba	.011±.004 .009±.004	.17±.004 .013±.004	.011±.004 .008±.004	.014±.004 .009±.004	.009±.004 .006±.004	±.004	100
Cd	.039±.01 .035±.01	.076±.01 .069±.01	.088±.01 .042±.01	.067±.01 .042±.01	.038±.01 .028±.01	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	.05±.02 .05±.02	.32±.02 .24±.02	.25±.02 .17±.02	.33±.02 .30±.02	.21±.02 .25±.02	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	.04±.03 <.03	.04±.03 <.03	.06±.03 <.03	<.03	<.03	±.03	5
Se	.17±.07 .36±.07	.17±.07 .38±.07	.10±.07 .22±.07	.15±.07 .32±.07	.25±.07 <.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	<.006	.007±.006 .008±.006	.007±.006 .007±.006	.019±.006 .011±.006	.017±.006 .020±.006	±.006	

TABLE 4.1.1(a).1 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
WASTE CALCINED AT 1100°C; 10°C DIW

RW11-1 -2	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 77	DAY 87	DAY 93	DAY 103	DAY		
Si	.05±.02 .03±.02	.06±.02 .04±.02	.08±.02 .03±.02	.06±.02 .04±.02		±.02	
Ca	.242±.012 .166±.008	.126±.006 .139±.007	.098±.005 .107±.007	.092±.005 .084±.004		±.002	
Na							
Al	<.11	<.11	.17±.11 <.11	<.11		±.11	
Fe	<.01	<.01	<.01	<.01		±.01	
Ti	<.02	<.02	<.02	<.02		±.02	
Ag	<.05	<.05	<.05	<.05		±.05	5
As	<.08	<.08	<.08	<.08		±.08	5
B	<.07	<.07	<.07	<.07		±.07	500
Ba	.008±.004 .006±.004	.007±.004 .004±.004	.01±.004 <.004	.008±.004 <.004		±.004	100
Cd	.043±.01 .033±.01	.033±.01 .02±.01	.038±.01 .015±.01	.038±.01 .018±.01		±.01	.5
Co	<.01	<.01	.012±.01 <.01	.012±.01 <.01		±.01	-
Cr	<.007	<.007	<.007	<.007		±.007	5
Cu	.2±.02 .27±.02	.21±.02 .31±.02	.23±.02 .30±.02	.26±.02 .35±.02		±.02	
Hg	<.02	<.02	<.02	<.02		±.02	.1
Ni	<.02	<.02	<.02	<.02		±.02	
Pb	<.03	<.03	.05±.03 <.03	<.03		±.03	5
Se	.27±.07 <.07	.08±.07 .25±.07	.08±.07 .21±.07	.25±.07 <.07		±.07	1
U	<.5	<.5	<.5	<.5		±.5	2
Zn	.012±.006 .014±.006	.012±.006 .014±.006	.014±.006 .016±.006	.013±.006 .02±.006		±.006	

TABLE 4.1.1(a).2
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
WASTE CALCINED AT 1100°C; 10°C; HAc

RW11-3 -4	SOLUTION CONCENTRATION (µg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 7	DAY 14	DAY 21	DAY 28	DAY 35		
Si	.06	.08 .11	.11 .13	.09	.07 .13	±.02	
Ca	.177±.009 .056±.013	.222±.011 .235±.013	.210±.051 .232±.012	.124±.006	.108±.005 .143±.007	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	<.01	<.01	<.01	<.01	.013	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	.14	.09 .10	.08 <.07	<.07	<.07	±.07	500
Ba	.009 <.004	.016 .007	.017 .008	.012 .006	.014 .013	±.004	100
Cd	<.01 .022	.041 .046	.057 .046	.041	.054 .169	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	.04	.12 .11	.19 .14	.16 .17	.23 .67	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	<.03	<.03	.05 <.03	<.03	.06 .09	±.03	5
Se	0.89 <.07	.71 <.07	.45 <.07	.27 <.07	.22 <.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	.007 <.006	.010 .011	.016 .014	.012 .014	.01 .014	±.006	

TABLE 4.1.1(a).2 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
WASTE CALCINED AT 1100°C, 10°C; HAc

RW11-3 -4	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 42	DAY 49	DAY 56	DAY 64	DAY 70		
Si	.14±.02 .17±.02	.27±.02 .20±.02	.18±.02 .31±.02	.16±.02 .34±.02	.09±.02 .22±.02	±.02	
Ca	.162±.008 .137±.007	.258±.013 .194±.01	.56±.03 .252±.013	.203±.01 .302±.025	.201±.01 .204±.01	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	.016±.01 <.01	.02±.01 <.01	.02±.01 <.01	.012±.01 <.01	.028±.01 <.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	.08±.08 <.08	.17±.08 <.08	.11±.08 .10±.08	.15±.08 .16±.08	.08±.08 .08±.08	±.08	5
B	<.07	.10±.07 .07±.07	<.07	.11±.07 <.07	<.07	±.07	500
Ba	.026±.004 .016±.004	.029±.004 .020±.004	.022±.004 .025±.004	.023±.004 .027±.004	.016±.004 .017±.004	±.004	100
Cd	.028±.01 .027±.01	.53±.03 .39±.02	.379±.019 .58 ±.03	.311±.016 .270±.04	.193±.01 .46 ±.01	±.01	.5
Co	<.01	<.01	.219±.01 <.01	.018±.01 <.01	.18±.01 <.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	1.38±.07 .98±.05	3.28±.16 1.29±.06	2.59±.13 1.67±.08	4.0±.2 1.77±.09	2.58±.13 1.12±.13	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	.12±.03 .12±.03	.26±.03 .19±.03	.20±.03 .26±.03	.21±.03 .24±.03	.13±.03 .18±.03	±.03	5
Se	.48±.07 .08±.07	.95±.05 <.07	.67±.07 <.07	1.18±.06 <.07	.71±.07 <.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	.010±.006 .012±.006	.015±.006 .013±.006	.019±.006 .017±.006	.024±.006 .034±.006	.023±.006 .025±.006	±.006	

TABLE 4.1.1(a).2 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
WASTE CALCINED AT 1100°C, 10°; HAc

RW11-3 -4	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 77	DAY 87	DAY 93	DAY 103	DAY		
Si	.07±.02 .31±.02	.10±.02 .31±.02	.11±.02 .27±.02	.11±.02 .29±.02		±.02	
Ca	.169±.008 .53 ±.03	.143±.007 .370±.019	.135±.007 .298±.015	.163±.008 .27 ±.03		±.002	
Na							
Al	<.11	<.11	<.11	<.11		±.11	
Fe	.036±.01 <.01	.034±.01 <.01	.035±.01 <.01	.035±.01 <.01		±.01	
Ti	<.02	<.02	<.02	<.02		±.02	
Ag	<.05	<.05	<.05	<.05		±.05	5
As	.09±.08 .14±.08	.13±.08 <.08	.09±.08 .15±.08	.08±.08 .19±.08		±.08	5
B	.09±.07 <.07	.09±.07 <.07	.07±.07 <.07	.013±.004 .02 ±.004		±.07	500
Ba	.015±.004 .027±.004	.013±.004 .021±.004	.013±.004 .018±.004	<.004		±.004	100
Cd	.142±.01 .63 ±.04	.152±.01 .64 ±.03	.169±.01 .53 ±.01	.155±.01 .54 ±.04		±.01	.5
Co	.019±.01 <.01	.013±.01 <.01	.011±.01 <.01	.016±.01 <.01		±.01	-
Cr	<.007	<.007	<.007	<.007		±.007	5
Cu	2.58±.13 1.45±.06	2.97±.15 1.36±.07	2.99±.15 1.12±.07	2.82±.14 1.11±.06		±.02	
Hg	<.02	<.02	<.02	<.02		±.02	.1
Ni	<.02	<.02	<.02	<.02		±.02	
Pb	.04±.03 .22±.03	.05±.03 .23±.03	.11±.03 .24±.03	.12±.03 .28±.03		±.03	5
Se	.67±.07 <.07	.72±.07 <.07	.69±.07 <.07	.42±.07 <.07		±.07	1
U	<.5	<.5	<.5	<.5		±.5	2
Zn	.015±.006 .039±.006	.022±.006 .034±.006	.022±.006 .033±.006	.018±.006 .028±.006		±.006	

TABLE 4.1.1(a).3
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
WASTE CALCINED AT 1400°C; 10°C; DIW

RW14-1 -2	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 7	DAY 14	DAY 21	DAY 28	DAY 35		
Si	.04 .05	.03 .04	.05 .04	.03 .04	.03 .02	±.02	
Ca	.048 .027	.048 .026	.091±.005 .038	.039 .036	.027 .026	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	<.01	<.01	.01 <.01	<.01	<.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	.12 .14	.08	<.07	<.07	<.07	±.07	500
Ba	<.004	<.004	<.004	<.004	<.004	±.004	100
Cd	<.01	<.01	<.01	<.01	<.01	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	<.02	<.02	.04 <.02	.02 <.02	.02 <.02	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	<.03	.03 .04	.05 <.03	<.03	<.03	±.03	5
Se	<.07	<.07	<.07	<.07	<.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	<.006	<.006	.011 .009	.007	.006 <.006	±.006	

TABLE 4.1.1(a).3 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
WASTE CALCINED AT 1400°C, 10°C; DIW

RW14-1 -2	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 42	DAY 49	DAY 56	DAY 64	DAY 70		
Si	<.02	<.02	<.02	<.02	<.02	±.02	
Ca	.027±.002 .041±.002	.087±.004 .105±.005	.088±.003 .073±.004	.063±.003 .061±.003	.239±.012 .130±.007	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	<.01	<.01	<.01	<.01	<.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	<.07	<.07	<.07	<.07	<.07	±.07	500
Ba	<.004	<.004	<.004	<.004	<.004	±.004	100
Cd	<.01	<.01	<.01	<.01	<.01	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	<.02	.03±.02 <.02	.02±.02 <.02	.02±.02 <.02	<.02	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	<.03	<.03	<.03	<.03	<.03	±.03	5
Se	<.07	<.07	<.07	<.07	<.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	<.006	.007±.006 <.006	.007±.006 .006±.006	.011±.006 .014±.006	.018±.006 .014±.006	±.006	

TABLE 4.1.1(a).3 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
WASTE CALCINED AT 1400°C, 10°C; DIW

RW14-1 -2	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 77	DAY 87	DAY 93	DAY 103	DAY		
Si	<.02	<.02	<.02	<.02		±.02	
Ca	.214±.012 .131±.007	.122±.006 .094±.005	.177±.006 .08 ±.004	.222±.011 .075±.004		±.002	
Na							
Al	<.11	<.11	<.11	<.11		±.11	
Fe	<.01	<.01	<.01	<.01		±.01	
Ti	<.02	<.02	<.02	<.02		±.02	
Ag	<.05	<.05	<.05	<.05		±.05	5
As	<.08	<.08	<.08	<.08		±.08	5
B	<.07	<.07	<.07	<.07		±.07	500
Ba	<.004	<.004	<.004	<.004		±.004	100
Cd	<.01	<.01	<.01	<.01		±.01	.5
Co	<.01	<.01	<.01	<.01		±.01	-
Cr	<.007	<.007	<.007	<.007		±.007	5
Cu	<.02	<.02	<.02	<.02		±.02	
Hg	<.02	<.02	<.02	<.02		±.02	.1
Ni	<.02	<.02	<.02	<.02		±.02	
Pb	<.03	<.03	<.03	.04±.03 <.03		±.03	5
Se	<.07	<.07	<.07	<.07		±.07	1
U	<.5	<.5	<.5	<.5		±.5	2
Zn	.011±.006 .008±.006	.011±.006 .010±.006	.012±.006 .010±.006	.018±.006 .011±.006		±.006	

TABLE 4.1.1(a).4
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
WASTE CALCINED AT 1400°C; 10°C; HAc

RW14-3 -4	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 7	DAY 14	DAY 21	DAY 28	DAY 35		
Si	.06 .06	.05 .04	.06	.05 .04	.03	±.02	
Ca	.231±.012 .066±.003	.167±.008 .055±.003	.145±.007 .163±.008	.087±.004 .031	.071±.004 .032	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	<.01	<.01	<.01	<.01	<.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	.13 .18	.09 .10	.07 .07	.13 <.07	<.07	±.07	500
Ba	<.004	<.004	<.004	<.004	<.004	±.004	100
Cd	<.01	<.01	<.01	<.01	<.01	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	<.02	<.02	<.02	<.02	<.02	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	<.03	<.03	<.03	<.03	<.03	±.03	5
Se	<.07	<.07	<.07	<.07	<.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	.007 .008	.007 .006	.007	.006 .007	<.006	±.006	

TABLE 4.1.1(a).4 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
WASTE CALCINED AT 1400°C, 10°C; HAc

RW14-3 -4	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 42	DAY 49	DAY 56	DAY 64	DAY 70		
Si	.04±.02 .06±.02	.13±.02 .11±.02	.09±.02 .14±.02	.16±.02 .15±.02	.09±.02 .11±.02	±.02	
Ca	.047±.008 .038±.008	.166±.008 .100±.005	.112±.006 .114±.006	.356±.018 .105±.005	.111±.006 .102±.005	±.002	
Na							
Al	<.11	<.11	<.11	.12±.11 <.11	.11±.11 <.11	±.11	
Fe	<.01	.013±.01 .013±.01	.016±.01 <.01	.02±.01 .02±.01	.015±.01 <.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	<.07	<.07	<.07	<.07	<.07	±.07	500
Ba	.005±.004 <.004	.011±.004 .011±.004	.009±.004 .013±.004	.015±.004 .014±.004	.01 ±.004 .012±.004	±.004	100
Cd	<.01	.017±.01 .017±.01	.011±.01 .02 ±.01	.02 ±.01 .017±.01	.01±.01 <.01	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	.05±.02 .02±.02	.09±.02 .05±.02	.06±.02 .07±.02	.09±.02 .07±.02	.05±.02 .05±.02	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	.03±.03 <.03	.04±.03 .12±.03	.07±.03 .06±.03	.03±.03 <.03	<.03	±.03	5
Se	<.07	<.07	<.07	<.07	<.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	<.006	.007±.006 <.006	<.006	.017±.006 .012±.006	.012±.006 .012±.006	±.006	

TABLE 4.1.1(a).4 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
WASTE CALCINED AT 1400°C, 10°C; HAc

RW14-3 -4	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 77	DAY 87	DAY 93	DAY 103	DAY		
Si	.08±.02 .11±.02	.15±.02 .11±.02	.12±.02 .10±.02	.15±.02 .11±.02		±.02	
Ca	.125±.006 .120±.006	.140±.007 .118±.006	.238±.012 .42 ±.02	.262±.013 .197±.006		±.002	
Na							
Al	<.11	<.11	<.11	<.11		±.11	
Fe	.012±.01 <.01	.023±.01 .017±.01	.014±.01 .019±.01	.021±.01 .019±.01		±.01	
Ti	<.02	<.02	<.02	<.02		±.02	
Ag	<.05	<.05	<.05	<.05		±.05	5
As	<.08	<.08	<.08	<.08		±.08	5
B	<.07	<.07	<.07	<.07		±.07	500
Ba	.013±.004 .012±.004	.012±.004 .010±.004	.01 ±.004 .009±.004	.014±.004 .012±.004		±.004	100
Cd	.016±.01 .015±.01	.013±.01 <.01	.012±.01 .011±.01	.015±.01 <.01		±.01	.5
Co	<.01	<.01	<.01	<.01		±.01	-
Cr	<.007	<.007	<.007	<.007		±.007	5
Cu	.03±.02 .06±.02	.07±.02 .04±.02	.06±.02 .03±.02	.07±.02 .04±.02		±.02	
Hg	<.02	<.02	<.02	<.02		±.02	.1
Ni	<.02	<.02	<.02	<.02		±.02	
Pb	<.03	<.03	<.03	<.03		±.03	5
Se	<.07	<.07	<.07	<.07		±.07	1
U	<.5	<.5	<.5	<.5		±.5	2
Zn	.008±.006 .008±.006	.012±.006 .011±.006	.015±.006 .034±.006	.02 ±.006 .018±.006		±.006	

TABLE 4.1.1(b).1
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
WASTE CALCINED 1100°C; AT 22.5°C; DIW

RW11-1 -2	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 110	DAY 116	DAY 123	DAY 131	DAY 138		
Si	<.02	<.02	<.02	<.02	<.02	±.02	
Ca	<.002	<.002	<.002	<.002	<.002	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	<.01	<.01	<.01	<.01	<.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	<.07	<.07	<.07	<.07	<.07	±.07	500
Ba	.07±.004 <.004	.007±.004 .005±.004	.008±.004 .006±.004	.008±.004 .007±.004	.008±.004 .006±.004	±.004	100
Cd	.043±.01 .013±.01	.044±.01 .016±.01	.051±.01 .019±.01	.047±.01 .026±.01	.038±.01 .025±.01	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	.26±.02 .36±.02	.27±.02 .39±.02	.33±.02 .54±.03	.31±.02 .64±.03	.47±.02 .65±.03	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	<.03	<.03	.04±.03 <.03	<.03	<.03	±.03	5
Se	.09±.07 .24±.07	.17±.07 .29±.07	.18±.07 .41±.07	.17±.07 .46±.07	.31±.07 .48±.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	<.006	<.006	<.006	<.006	<.006	±.006	

TABLE 4.1.1(b).1 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
WASTE CALCINED AT 1100°C; 22.5°C DIW

RW11-1 -2	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 148	DAY 155	DAY 163	DAY 171	DAY 180		
Si	.08 .06	.08 .07	.06 .05	.07 .06	.06 .05	±.02	
Ca	.073±.004 .161±.008	.113±.006 .086±.004	.08 ±.004 .099±.004	.14 ±.007 .174±.009	.247±.012 .226±.011	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	<.01	<.01	<.01	<.01	<.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	<.07	<.07	<.07	<.07	<.07	±.07	500
Ba	.008±.004 .007±.004	.007±.004 .005±.004	.006±.004 .005±.004	.004±.004 .004±.004	.004±.004 <.004	±.004	100
Cd	.03 ±.01 .027±.01	.022±.01 .022±.01	.018±.01 .02 ±.01	.015±.01 .021±.01	.014±.01 .015±.01	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	.60±.03 .81±.03	.61±.02 .71±.03	.55±.03 .79±.03	.48±.02 .62±.03	.44±.03 .52±.03	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	<.03	<.03	<.03	<.03	<.03	±.03	5
Se	.43±.07 .50±.07	.42±.07 .35±.07	.37±.07 .39±.07	.25±.07 .30±.07	.24±.07 .28±.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	.012±.006 .018±.006	.018 .020	.015±.006 .020±.006	.017±.006 .020±.006	.024 .018	±.006	

TABLE 4.1.1(b).1 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
WASTE CALCINED AT 1100°C; 22.5°C; DIW

RW11-1 -2	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 187	DAY 194					
Si	.06 .04	.05 .03				±.02	
Ca	.357±.018 .42 ±.02	.224±.011 .175±.009				±.002	
Na							
Al	<.11	<.11				±.11	
Fe	<.01	<.01				±.01	
Ti	<.02	<.02				±.02	
Ag	<.05	<.05				±.05	5
As	<.08	<.08				±.08	5
B	<.07	<.07				±.07	500
Ba	.004±.004 <.004	<.004				±.004	100
Cd	<.01	<.01				±.01	.5
Co	<.01	<.01				±.01	-
Cr	<.007	<.007				±.007	5
Cu	.45±.03 .44±.03	.36 .41				±.02	
Hg	<.02	<.02				±.02	.1
Ni	<.02	<.02				±.02	
Pb	<.03	<.03				±.03	5
Se	.24±.07 .17±.07	.17±.07 .13±.07				±.07	1
U	<.5	<.5				±.5	2
Zn	.022 .019	.013 .011				±.006	

TABLE 4.1.1(b).2
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
WASTE CALCINED AT 1100°C; 22.5°C; HAc

RW11-3 -4	SOLUTION CONCENTRATION (µg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 110	DAY 116	DAY 123	DAY 131	DAY 138		
Si	<.02	<.02	.17±.02 .24±.02	.16±.02 .18±.02	<.02	±.02	
Ca	<.002	<.002	.363±.018 .174±.009	<.002	<.002	±.002	
Na							
Al	.12±.11 <.11	<.11	<.11	<.11	<.11	±.11	
Fe	.013±.01 .026±.01	<.01	<.01	<.01	<.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	.12±.08 .14±.08	.18±.08 <.08	.15±.08 <.08	.14±.08 <.08	<.08	±.08	5
B	<.07	<.07	<.07	<.07	<.07	±.07	500
Ba	.07±.004 .0L6±.004	.01±.004 .013±.004	.007±.004 .009±.004	.006±.004 .006±.004	.005±.004 <.004	±.004	100
Cd	.153±.008 .383±.008	.127±.01 .307±.015	.084±.01 .197±.01	.052±.01 .117±.01	.033±.01 .089±.01	±.01	.5
Co	0.11±.01 <.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	2.62±.13 .80±.04	2.03±.10 .59±.03	1.16±.06 .31±.03	.66±.10 .16±.03	.44±.02 .12±.03	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	.12±.03 .20±.03	.06±.03 .10±.03	<.03	.04±.03 <.03	<.03	±.03	5
Se	.30±.07 <.07	.21±.07 <.07	.13±.07 <.07	.10±.07 <.07	.07±.07 <.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	<.006	<.006	<.006	<.006	<.006	±.006	

TABLE 4.1.1(b).2 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
WASTE CALCINED AT 1100°C; 22.5°C; HAc

RW11-3 11-4	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 148	DAY 155	DAY 163	DAY 171	DAY 180		
Si	.11 .14	.10 .12	.06 .10	.07 .11	.05 .10	±.02	
Ca	.153±.008 .078±.004	.49 ±.02 .067±.003	.077±.004 .159±.008	.057±.003 .138±.007	.186±.009 .210±.011	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	<.01	<.01	<.01	<.01	<.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	<.07	<.07	<.07	<.07	<.07	±.07	500
Ba	.005±.004 <.004	<.004	<.004	<.004	<.004	±.004	100
Cd	.024±.01 .068±.01	.014±.01 .051±.01	.043±.01 <.01	.01 ±.01 .043±.01	.014±.01 .041±.01	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	.34±.02 .11±.03	.29±.02 .10±.02	.24±.02 .08±.02	.25±.02 .09±.02	.22±.02 .08±02	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	<.03	<.03	<.03	<.03	.06±.03 <.03	±.03	5
Se	<.07	<.07	<.07	<.07	<.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	.009 .010	.013 .009	.009±.006 .013±.006	.011±.006 .013±.006	.013±.006 .016±.006	±.006	

TABLE 4.1.1(b).2 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
WASTE CALCINED AT 100°C; 22.5°C; HAc

RW11-3 -4	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 187	DAY 197					
Si	.04 .08	.04 .07				±.02	
Ca	.47 ±.013 .344±.017	.176±.009 .207±.010				±.002	
Na							
Al	<.11	<.11				±.11	
Fe	<.01	<.01				±.01	
Ti	<.02	<.02				±.02	
Ag	<.05	<.05				±.05	5
As	<.08	<.08				±.08	5
B	<.07	<.07				±.07	500
Ba	<.004	<.004				±.004	100
Cd	.34±.01 <.01	.029 <.01				±.01	.5
Co	<.01	<.01				±.01	-
Cr	<.007	<.007				±.007	5
Cu	.19±.02 .08±.02	.17 .07				±.02	
Hg	<.02	<.02				±.02	.1
Ni	<.02	<.02				±.02	
Pb	<.03	<.03				±.03	5
Se	<.07	<.07				±.07	1
U	<.5	<.5				±.5	2
Zn	.014 .014	.013 .010				±.006	

TABLE 4.1.1(b).3
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
WASTE CALCINED AT 1400°C; 22.5°C; DIW

RW14-1 -2	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 110	DAY 116	DAY 123	DAY 131	DAY 138		
Si	<.02	<.02	<.02	<.02	<.02	±.02	
Ca	<.002	<.002	.42±.021 .068±.003	<.002	<.002	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	<.01	<.01	<.01	<.01	<.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	<.07	<.07	<.07	<.07	<.07	±.07	500
Ba	<.004	<.004	<.004	<.004	<.004	±.004	100
Cd	<.01	<.01	<.01	<.01	<.01	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	<.02	<.02	<.02	<.02	<.02	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	<.03	<.03	<.03	<.03	<.03	±.03	5
Se	<.07	<.07	<.07	<.07	<.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	<.006	<.006	<.006	<.006	<.006	±.006	

TABLE 4.1.1(b).3 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
WASTE CALCINED AT 1400°C; 22.5°C; DIW

RW14-1 -2	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 148	DAY 155	DAY 163	DAY 171	DAY 180		
Si	.05 .06	.05 .06	.03 .04	.04 .05	.04 .04	±.02	
Ca	.088±.004 .116±.006	.064±.003 .059±.002	.053±.003 .054±.003	.067±.003 .051±.003	.19 ±.01 .216±.011	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	<.01	<.01	<.01	<.01	<.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	<.07	<.07	<.07	<.07	<.07	±.07	500
Ba	<.004	<.004	<.004	<.004	<.004	±.004	100
Cd	<.01	<.01	<.01	<.01	<.01	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	<.02	<.02	<.02	<.02	.03±.02 <.02	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	<.03	<.03	<.03	<.03	<.03	±.03	5
Se	<.07	<.07	<.07	<.07	<.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	.013 .014	.013 .009	.01 .007	.012 .008	.031 .027	±.006	

TABLE 4.1.1(b).3 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
WASTE CALCINED AT 1400°; 22.5°C; DIW

RW14-1 -2	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 187	DAY 194					
Si	.03 .04	.02 .03				±.02	
Ca	1.02±.05 .36±.018	.168±.008 .167±.008				±.002	
Na							
Al	<.11	<.11				±.11	
Fe	<.01	<.01				±.01	
Ti	<.02	<.02				±.02	
Ag	<.05	<.05				±.05	5
As	<.08	<.08				±.08	5
B	<.07	<.07				±.07	500
Ba	<.004	<.004				±.004	100
Cd	<.01	<.01				±.01	.5
Co	<.01	<.01				±.01	-
Cr	<.007	<.007				±.007	5
Cu	.03±.02 .04±.02	.02 <.02				±.02	
Hg	<.02	<.02				±.02	.1
Ni	<.02	<.02				±.02	
Pb	<.03	<.03				±.03	5
Se	<.07	<.07				±.07	1
U	<.5	<.5				±.5	2
Zn	.03 .02	.014 .013				±.006	

TABLE 4.1.1(b).4
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
WASTE CALCINED AT 1400°C; 22.5°C; HAc

RW14-3 -4	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 110	DAY 116	DAY 123	DAY 131	DAY 138		
Si	<.02	<.02	<.02	<.02	.12±.02 .32±.02	±.02	
Ca	<.002	<.002	<.002	<.002	<.002	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	.012±.01 <.01	.018±.01 .011±.01	<.01	<.01	<.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	<.07	<.07	<.07	<.07	<.07	±.07	500
Ba	.017±.004 .008±.004	.C1±.004 .006±.004	.004±.004 <.004	<.004	<.004	±.004	100
Cd	<.01	.01±.01 <.01	<.01	<.01	<.01	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	.03±.02 .03±.02	.05±.02 .02±.02	<.02	<.02	<.02	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	<.03	<.03	<.03	<.03	<.03	±.03	5
Se	<.07	<.07	<.07	<.07	<.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	<.006	<.006	<.006	<.006	<.006	±.006	

TABLE 4.1.1(b).4 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
WASTE CALCINED AT 1400°C; 22.5°C; HAc

RW14-3 -4	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 148	DAY 155	DAY 163	DAY 171	DAY 180		
Si	.10 .11	.07 .09	.06 .07	.05 .06	.06 .06	±.02	
Ca	.122±.006 .047±.002	.075±.004 .043±.002	.06±.003 .02±.002	.077±.004 .027±.002	.196±.01 .223±.011	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	<.01	<.01	<.01	<.01	<.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	<.07	<.07	<.07	<.07	<.07	±.07	500
Ba	<.004	<.004	<.004	<.004	<.004	±.004	100
Cd	<.01	<.01	<.01	<.01	<.01	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	<.02	<.02	<.02	<.02	<.02	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	<.03	<.03	<.03	<.03	<.03	±.03	5
Se	<.07	<.07	<.07	<.07	<.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	.01 <.006	.009 .006±.006	.008 .007	.009 .008	.019 .016	±.006	

TABLE 4.1.1(b).4 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
WASTE CALCINED AT 1400°; 22.5°C; HAc

RW14-3 -4	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 187	DAY 194					
Si	.05 .06	.04 .04				±.02	
Ca	.223±.011 .253±.013	.181±.009 .173±.009				±.002	
Na							
Al	<.11	<.11				±.11	
Fe	<.01	<.01				±.01	
Ti	<.02	<.02				±.02	
Ag	<.05	<.05				±.05	5
As	<.08	<.08				±.08	5
B	<.07	<.07				±.07	500
Ba	<.004	<.004				±.004	100
Cd	<.01	<.01				±.01	.5
Co	<.01	<.01				±.01	-
Cr	<.007	<.007				±.007	5
Cu	<.02	<.02				±.02	
Hg	<.02	<.02				±.02	.1
Ni	<.02	<.02				±.02	
Pb	<.03	<.03				±.03	5
Se	<.07	<.07				±.07	1
U	<.5	<.5				±.5	2
Zn	.011 .01	.022 .007				±.006	

TABLE 4.1.2(a).1
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
90% GLASS/10% CALCINED WASTE 10°C; DIW

CW9-1 -2	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 7	DAY 14	DAY 21	DAY 28	DAY 35		
Si	.04 <.02	.03 <.02	.04 .03	.02 .02	.02 <.02	±.02	
Ca	.033 .009	.025 .007	.058±.003 .108±.005	.015 .068±.003	.02 .053±.003	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	<.01	<.01	<.01	<.01	<.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	.12 <.07	.07 <.07	<.07	<.07	<.07	±.07	500
Ba	<.004	<.004	<.004	<.004	<.004	±.004	100
Cd	<.01	<.01	<.01	<.01	<.01	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	<.02	<.02	<.02	<.02	<.02	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	<.03	<.03	<.03	<.03	<.03	±.03	5
Se	<.07	<.07	<.07	<.07	<.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	<.006	<.006	.009 <.006	<.006 .007	<.006	±.006	

TABLE 4.1.2(a).1 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
90% GLASS/10% CALCINED WASTE 10°C; DIW

CW9-1 -2	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 42	DAY 49	DAY 56	DAY 64	DAY 70		
Si	<.02	<.02	<.02	<.02	<.02	±.02	
Ca	.021±.002 .003±.002	.038±.002 .099±.005	.053±.003 .098±.005	.095±.005 .104±.005	.157±.008 .162±.008	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	<.01	<.01	<.01	<.01	<.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	<.07	<.07	<.07	<.07	<.07	±.07	500
Ba	<.004	<.004	<.004	<.004	<.004	±.004	100
Cd	<.01	<.01	<.01	<.01	<.01	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	<.02	<.02	<.02	<.02	<.02	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	<.03	<.03	<.03	<.03	<.03	±.03	
Se	<.07	<.07	<.07	<.07	<.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	<.006	<.006	.006±.006 <.006	.011±.006 <.006	.013±.006 <.006	±.006	

TABLE 4.1.2(a).1 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
90% GLASS/10% CALCINED WASTE 10°C;DIW

CW9-1 -2	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 77	DAY 87	DAY 93	DAY 103	DAY		
Si	<.02	.02±.02 <.02	<.02	<.02		±.02	
Ca	.119±.006 .144±.007	.096±.005 .179±.009	.102±.005 .103±.009	.079±.004 .072±.004		±.002	
Na							
Al	<.11	<.11	<.11	<.11		±.11	
Fe	<.01	<.01	<.01	<.01		±.01	
Ti	<.02	<.02	<.02	<.02		±.02	
Ag	<.05	<.05	<.05	<.05		±.05	5
As	<.08	<.08	<.08	<.08		±.08	5
B	<.07	<.07	<.07	<.07		±.07	500
Ba	<.004	<.004	<.004	<.004		±.004	100
Cd	<.01	<.01	<.01	<.01		±.01	.5
Co	<.01	<.01	<.01	<.01		±.01	-
Cr	<.007	<.007	<.007	<.007		±.007	5
Cu	<.02	<.02	<.02	<.02		±.02	
Hg	<.02	<.02	<.02	<.02		±.02	.1
Ni	<.02	<.02	<.02	<.02		±.02	
Pb	<.03	<.03	<.03	<.03		±.03	5
Se	<.07	<.07	<.07	<.07		±.07	1
U	<.5	<.5	<.5	<.5		±.5	2
Zn	.009±.006 .009±.006	.011±.006 .012±.006	.012±.006 .01 ±.006	.012±.006 .01 ±.006		±.006	

TABLE 4.1.2(a).2

LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR: 90% GLASS(ss)/10% CALCINED WASTE 10°C; DIW

RW9-1 -2	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 7	DAY 14	DAY 21	DAY 28	DAY 35		
Si	.03 .03	.04 .04	.05 .05	.04 .04	.04 .05	±.02	
Ca	.009 .010	.017 .013	.068±.003 .035	.055±.004 .013	.055±.003 .017	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	<.01	<.01	.015 <.01	<.01	<.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	.10 .09	.07 .08	<.07	.09 <.07	<.07	±.07	500
Ba	<.004	<.004	<.004	<.004	<.004	±.004	100
Cd	<.01	<.01	<.01	<.01	<.01	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	–
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	<.02	<.02	<.02	<.02	<.02	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	<.03	<.03	.06 <.03	.03 <.03	<.03	±.03	5
Se	<.07	<.07	<.07	<.07	<.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	<.006	.008 <.006	.008 <.006	.007 <.006	<.006	±.006	

TABLE 4.1.2(a).2 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
90% GLASS (SS) /10% CALCINED WASTE 10°C;DIW

SR9-1 -2	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 42	DAY 49	DAY 56	DAY 64	DAY 70		
Si	.02±.02 <.02	<.02	<.02	<.02	<.02	±.02	
Ca	.008±.002	.170±.009 .046±.002	.61±.03 .043±.002	.083±.004 .039±.002	.136±.007 .115±.006	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	<.01	<.01	<.01	<.01	<.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	<.07	<.07	<.07	<.07	<.07	±.07	500
Ba	<.004	<.004	<.004	<.004	<.004	±.004	100
Cd	<.01	<.01	<.01	<.01	<.01	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	<.02	<.02	<.02	<.02	<.02	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	.05±.03 <.03	<.03	.04±.03 <.03	<.03	<.03	±.03	5
Se	<.07	<.07	<.07	<.07	<.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	<.006	<.006	.011±.006 <.006	.012±.006 .011±.006	.016±.006 .013±.006	±.006	

TABLE 4.1.2(a).2 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
90% GLASS (SS)/10% CALCINED WASTE 10°C; DIW

SR9-1 -2	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 77	DAY 87	DAY 93	DAY 103	DAY		
Si	<.02	<.02	<.02	<.02		±.02	
Ca	.137±.007 .105±.005	.130±.007 .088±.004	.155±.008 .111±.006	.196±.01 .096±.005		±.002	
Na							
Al	<.11	<.11	<.11	<.11		±.11	
Fe	<.01	<.01	<.01	<.01		±.01	
Ti	<.02	<.02	<.02	<.02		±.02	
Ag	<.05	<.05	<.05	<.05		±.05	5
As	<.08	<.08	<.08	<.08		±.08	5
B	<.07	<.07	<.07	<.07		±.07	500
Ba	<.004	<.004	<.004	<.004		±.004	100
Cd	<.01	<.01	<.01	<.01		±.01	.5
Co	<.01	<.01	<.01	<.01		±.01	-
Cr	<.007	<.007	<.007	<.007		±.007	5
Cu	<.02	<.02	<.02	<.02		±.02	
Hg	<.02	<.02	<.02	<.02		±.02	.1
Ni	<.02	<.02	<.02	<.02		±.02	
Pb	<.03	<.03	<.03	<.03		±.03	5
Se	<.07	<.07	<.07	<.07		±.07	1
U	<.5	<.5	<.5	<.5		±.5	2
Zn	.009±.006 .009±.006	.012±.006 .012±.006	.011±.006 .011±.006	.012±.006 .022±.006		±.006	

TABLE 4.1.2(a).3
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
90% GLASS/10% CALCINED WASTE 10°C; HAc

CW9-3 -4	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 7	DAY 14	DAY 21	DAY 28	DAY 35		
Si	<.02 <.02	<.02 <.02	.04 .02	<.02 .03	.03 .03	±.02	
Ca	.026 .029	.023 .026	.030 .042	.022 .025	.026 .027	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	<.01	<.01	<.01	<.01	<.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	<.07	<.07	<.07	<.07	<.07	±.07	500
Ba	<.004	<.004	<.004	<.004	<.004	±.004	100
Cd	<.01	<.01	<.01	<.01	<.01	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	<.02	<.02	<.02	<.02	<.02	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	.04 <.03	<.03	<.03	<.03	<.03	±.03	5
Se	<.07	<.07	<.07	<.07	<.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	<.006	<.006	.007 <.006	<.006	.006 <.006	±.006	

TABLE 4.1.2(a).3 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
90% GLASS/10% CALCINED WASTE 10°C; HAc

CW9-3 -4	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 42	DAY 49	DAY 56	DAY 64	DAY 70		
Si	<.02	<.02	<.02	<.02	<.02	±.02	
Ca	.015±.002 .012±.002	.021±.002 .040±.002	.022±.004 .043±.002	.031±.002 .100±.005	.015±.002 .021±.002	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	<.01	<.01	<.01	<.01	<.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	<.07	<.07	<.07	<.07	<.07	±.07	500
Ba	<.004	<.004	<.004	<.004	<.004	±.004	100
Cd	<.01	<.01	<.01	<.01	<.01	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	<.02	<.02	<.02	<.02	<.02	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	<.03	.03±.03 <.03	<.03	<.03	<.03	±.03	5
Se	<.07	<.07	<.07	<.07	<.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	<.006	<.006	.006±.006 <.006	.012±.006 .013±.006	.009±.006 .010±.006	±.006	

TABLE 4.1.2(a).3 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
90% GLASS/10% CALCINED WASTE 10°C;HAc

CW9-3 -4	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 77	DAY 87	DAY 93	DAY 103	DAY		
Si	<.02	<.02	<.02	<.02		±.02	
Ca	.061±.003 .075±.004	.021±.002 .026±.002	.061±.003 .094±.002	.027±.002 .086±.004		±.002	
Na							
Al	<.11	<.11	<.11	<.11		±.11	
Fe	<.01	<.01	<.01	<.01		±.01	
Ti	<.02	<.02	<.02	<.02		±.02	
Ag	<.05	<.05	<.05	<.05		±.05	5
As	<.08	<.08	<.08	<.08		±.08	5
B	<.07	<.07	<.07	<.07		±.07	500
Ba	<.004	<.004	<.004	<.004		±.004	100
Cd	<.01	<.01	<.01	<.01		±.01	.5
Co	<.01	<.01	<.01	<.01		±.01	-
Cr	<.007	<.007	<.007	<.007		±.007	5
Cu	<.02	<.02	<.02	<.02		±.02	
Hg	<.02	<.02	<.02	<.02		±.02	.1
Ni	<.02	<.02	<.02	<.02		±.02	
Pb	<.03	<.03	<.03	<.03		±.03	5
Se	<.07	<.07	<.07	<.07		±.07	1
U	<.5	<.5	<.5	<.5		±.5	2
Zn	.007±.006 .006±.006	.009±.006 .009±.006	.012±.006 .011±.006	.008±.006 .011±.006		±.006	

TABLE 4.1.2(a).4
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
90% GLASS(ss)/10% CALCINED WASTE 10°C; HAc

SR9-3 -4	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 7	DAY 14	DAY 21	DAY 28	DAY 35		
Si	.25 <.02	.19 <.02	.17 .04	.14 .04	.09 .03	±.02	
Ca	.161±.008 .022	.132±.008 .052	.124±.006 .070	.087±.004 .043	.072±.004 .025	±.002	
Na							
Al	.16 <.11	<.11	<.11	<.11	<.11	±.11	
Fe	<.01	<.01	<.01	<.01	<.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	<.07 .11	<.07	.08 <.07	.09 <.07	<.07	±.07	500
Ba	<.004	<.004	<.004	<.004	<.004	±.004	100
Cd	<.01	<.01	<.01	<.01	<.01	±.01	.5
Co	.01 <.01	<.01	<.01	.01 <.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	<.02	<.02	<.02	<.02	<.02	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	.09 <.03	<.03	<.03	<.03	<.03	±.03	5
Se	<.07	<.07	<.07	<.07	<.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	<.006	<.006	.007 .008	.008 <.006	<.006	±.006	

TABLE 4.1.2(a).4 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
90% GLASS (SS)/10% CALCINED WASTE 10°C; HAc

SR9-3 -4	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 42	DAY 49	DAY 56	DAY 64	DAY 70		
Si	.21±.02 <.02	.18±.02 <.02	.13±.02 <.02	<.02	.08±.02 <.02	±.02	
Ca	.058±.003 .013±.002	.080±.004 .083±.004	.064±.003 .117±.006	.043±.002 .112±.006	.055±.003 .061±.003	±.002	
Na							
Al	.15±.11 <.11	.21±.11 <.11	.13±.11 <.11	<.11	<.11	±.11	
Fe	<.01	<.01	<.01	<.01	<.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	<.07	<.07	<.07	<.07	<.07	±.07	500
Ba	<.004	<.004	<.004	<.004	<.004	±.004	100
Cd	<.01	<.01	<.01	<.01	<.01	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	<.02	<.02	<.02	<.02	<.02	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	<.03	.07±.03 <.03	<.03	<.03	<.03	±.03	5
Se	<.07	<.07	<.07	<.07	<.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	<.006	.006±.006 .008±.006	.007±.006 .007±.006	.010±.006 .012±.006	.009±.006 .012±.006	±.006	

TABLE 4.1.2(a).4 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
90% GLASS (SS)/10% CALCINED WASTE 10°C; HAc

SR9-3 -4	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 77	DAY 87	DAY 93	DAY 103	DAY		
Si	.06±.02 <.02	.06±.02 <.02	.05±.02 <.02	.06±.02 <.02		±.02	
Ca	.063±.003 .125±.006	.044±.002 .143±.007	.260±.013 .057±.003	.120±.006 .103±.005		±.002	
Na							
Al	<.11	<.11	<.11	<.11		±.11	
Fe	<.01	<.01	<.01	<.01		±.01	
Ti	<.02	<.02	<.02	<.02		±.02	
Ag	<.05	<.05	<.05	<.05		±.05	5
As	<.08	<.08	<.08	<.08		±.08	5
B	<.07	<.07	<.07	<.07		±.07	500
Ba	<.004	<.004	<.004	<.004		±.004	100
Cd	<.01	<.01	<.01	<.01		±.01	.5
Co	<.01	<.01	<.01	<.01		±.01	-
Cr	<.007	<.007	<.007	<.007		±.007	5
Cu	<.02	<.02	<.02	<.02		±.02	
Hg	<.02	<.02	<.02	<.02		±.02	.1
Ni	<.02	<.02	<.02	<.02		±.02	
Pb	<.03	<.03	<.03	<.03		±.03	5
Se	<.07	<.07	<.07	<.07		±.07	1
U	<.5	<.5	<.5	<.5		±.5	2
Zn	.008±.006 <.006	.009±.006 .012±.006	.018±.006 .013±.006	.011±.006 .025±.006		±.006	

TABLE 4.1.2(a).5
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
60% GLASS/40% CALCINED WASTE 10°C; DIW

CW6-1 -2	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 7	DAY 14	DAY 21	DAY 28	DAY 35		
Si	.04 .04	.03 <.02	.04 .02	.03	.03 .02	±.02	
Ca	.042 .015	.028 .029	.073±.004 .070±.004	.016 .017	.021 .023	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	<.01	<.01	<.01	<.01	<.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	.12	.08 .08	<.07	<.07	<.07	±.07	500
Ba	<.004	<.004	<.004	<.004	<.004	±.004	100
Cd	<.01	<.01	<.01	<.01	<.01	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	<.02	<.02	<.02	<.02	<.02	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	<.03	<.03	<.03	<.03	<.03	±.03	5
Se	<.07	<.07	<.07	<.07	<.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	.009 <.006	<.006 .007	<.006	<.006	<.006	±.006	

TABLE 4.1.2(a).5 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
60% GLASS/40% CALCINED WASTE 10°C; DIW

CW6-1 -2	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 42	DAY 49	DAY 56	DAY 64	DAY 70		
Si	<.02	.02±.02 <.02	<.02	<.02	<.02	±.02	
Ca	.015±.002 <.002	.070±.004 .044±.004	.107±.005 .128±.006	.082±.004 .048±.004	.132±.007 .107±.005	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	<.01	<.01	<.01	<.01	<.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	<.07	<.07	<.07	<.07	<.07	±.07	500
Ba	<.004	<.004	<.004	<.004	<.004	±.004	100
Cd	<.01	<.01	<.01	<.01	<.01	±.01	.5
Co	.01±.01 <.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	<.02	<.02	<.02	<.02	<.02	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	<.03	.04±.03 <.03	<.03	<.03	<.03	±.03	5
Se	<.07	<.07	<.07	<.07	<.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	<.006	<.006	.008±.006 <.006	.015±.006 .029±.006	.014±.006 .015±.006	±.006	

TABLE 4.1.2(a).5 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
60% GLASS/40% CALCINED WASTE 10°C; DIW

CW6-1 -2	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 77	DAY 87	DAY 93	DAY 103	DAY		
Si	<.02	.02±.02 <.02	<.02	<.02		±.02	
Ca	.131±.006 .134±.007	.236±.012 .188±.009	.188±.012 .127±.009	.175±.009 .129±.009		±.002	
Na							
Al	<.11	<.11	<.11	<.11		±.11	
Fe	<.01	<.01	<.01	<.01		±.01	
Ti	<.02	<.02	<.02	<.02		±.02	
Ag	<.05	<.05	<.05	<.05		±.05	5
As	<.08	<.08	<.08	<.08		±.08	5
B	<.07	<.07	<.07	<.07		±.07	500
Ba	<.004	<.004	<.004	<.004		±.004	100
Cd	<.01	<.01	<.01	<.01		±.01	.5
Co	<.01	<.01	<.01	<.01		±.01	-
Cr	<.007	<.007	<.007	<.007		±.007	5
Cu	<.02	<.02	<.02	<.02		±.02	
Hg	<.02	<.02	<.02	<.02		±.02	.1
Ni	<.02	<.02	<.02	<.02		±.02	
Pb	<.03	<.03	<.03	<.03		±.03	5
Se	<.07	<.07	<.07	<.07		±.07	1
U	<.5	<.5	<.5	<.5		±.5	2
Zn	.009±.006 .009±.006	.02 ±.006 .015±.008	.016±.006 .014±.006	.015±.006 .014±.006		±.006	

TABLE 4.1.2(a).6
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
60% GLASS/40% CALCINED WASTE 10°C; HAc

CW6-3 -4	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 7	DAY 14	DAY 21	DAY 28	DAY 35		
Si	.03 .03	.03 .02	.05 .02	.04 .03	.03 .03	±.02	
Ca	.043 .026	.060 .024	.157±.008 .052	.057±.003 .028	.071±.004 .033	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	<.01	<.01	.011 <.01	<.01	.011 <.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	.11 .14	.10 .09	.07 <.07	<.07	<.07	±.07	500
Ba	<.004	<.004	<.004	<.004	<.004	±.004	100
Cd	<.01	<.01	<.01	<.01	<.01	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	<.02	<.02	<.02	<.02	<.02	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	<.03	<.03	<.03	.04 <.03	<.03	±.03	5
Se	<.07	<.07	<.07	<.07	<.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	.009 <.006	.011 <.006	.011 .008	.012 <.006	.010 <.006	±.006	

TABLE 4.1.2(a).6 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
60% GLASS/40% CALCINED WASTE 10°C; HAc

CW6-3 -4	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 42	DAY 49	DAY 56	DAY 64	DAY 70		
Si	.03±.02 <.02	<.02	<.02	<.02	<.02	±.02	
Ca	.034±.002 .008±.002	.072±.005 .050±.003	.146±.047 .037±.002	.065±.003 .202±.010	.066±.003 .076±.004	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	<.01	<.01	<.01	.012±.01 <.01	.015±.01 <.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	<.07	<.07	<.07	<.07	<.07	±.07	500
Ba	<.004	<.004	<.004	<.004	<.004	±.004	100
Cd	<.01	<.01	<.01	<.01	<.01	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	<.02	<.02	<.02	<.02	<.02	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	<.03	.03±.03 <.03	.05±.03 <.03	<.03	<.03	±.03	5
Se	<.07	<.07	<.07	<.07	<.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	.007±.006 <.006	.007±.006 <.006	.008±.006 <.006	.011±.006 .013±.006	.012±.006 .017±.006	±.006	

TABLE 4.1.2(a).6 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
60% GLASS/40% CALCINED WASTE 10°C; HAc

CW6-3 -4	SOLUTION CONCENTRATION (µg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 77	DAY 87	DAY 93	DAY 103	DAY		
Si	<.02	<.02	<.02	<.02		±.02	
Ca	.036±.002 .291±.015	.043±.002 .065±.003	.074±.002 .036±.003	.057±.003 .120±.006		±.002	
Na							
Al	<.11	<.11	<.11	<.11		±.11	
Fe	<.01	<.01	<.01	<.01		±.01	
Ti	<.02	<.02	<.02	<.02		±.02	
Ag	<.05	<.05	<.05	<.05		±.05	5
As	<.08	<.08	<.08	<.08		±.08	5
B	<.07	<.07	<.07	<.07		±.07	500
Ba	<.004	<.004	<.004	<.004		±.004	100
Cd	<.01	<.01	<.01	<.01		±.01	.5
Co	<.01	<.01	<.01	<.01		±.01	-
Cr	<.007	<.007	<.007	<.007		±.007	5
Cu	<.02	<.02	<.02	<.02		±.02	
Hg	<.02	<.02	<.02	<.02		±.02	.1
Ni	<.02	<.02	<.02	<.02		±.02	
Pb	<.03	<.03	<.03	<.03		±.03	5
Se	<.07	<.07	<.07	<.07		±.07	1
U	<.5	<.5	<.5	<.5		±.5	2
Zn	.010±.006 <.006	.01 ±.006 .011±.006	.013±.006 .013±.006	.008±.006 .014±.006		±.006	

TABLE 4.1.2(a).7
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
60% GLASS (ss)/40% CALCINED WASTE 10°C; DIW

SR6-1 -2	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 7	DAY 14	DAY 21	DAY 28	DAY 35		
Si	.04 <.02	.03 .03	.05 .04	.03 .04	.03 .03	±.02	
Ca	.033 .009	.014 .009	.023 .053±.003	.032 .031	.023 .017	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	<.01	<.01	<.01	<.01	<.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	.12 <.07	.09 .08	<.07 .08	<.07 .011	<.07	±.07	500
Ba	<.004	<.004	<.004	<.004	<.004	±.004	100
Cd	<.01	<.01	<.01	<.01	<.01	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	<.02	<.02	<.02	<.02	<.02	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	<.03	<.03	<.03	<.03	<.03	±.03	5
Se	<.07	<.07	<.07	<.07	<.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	<.006	<.006	<.006	.007 <.006	<.006	±.006	

TABLE 4.1.2(a).7 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
60% GLASS (SS) /40% CALCINED WASTE 10°C; DIW

SR6-1 -2	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 42	DAY 49	DAY 56	DAY 64	DAY 70		
Si	.02±.02 .02±.02	.02±.02 <.02	<.02	<.02	.02±.02 <.02	±.02	
Ca	.007±.002 <.002	.076±.004 .083±.004	.039±.002 .059±.003	.067±.003 .121±.006	.142±.007 .133±.007	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	<.01	<.01	<.01	<.01	<.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	<.07	<.07	<.07	<.07	<.07	±.07	500
Ba	<.004	<.004	<.004	<.004	<.004	±.004	100
Cd	<.01	<.01	<.01	<.01	<.01	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	<.02	<.02	<.02	<.02	<.02	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	<.03	<.03	<.03	<.03	<.03	±.03	5
Se	<.07	<.07	<.07	<.07	<.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	<.006	.006±.006 <.006	<.006	.013±.006 .017±.006	.013±.006 .014±.006	±.006	

TABLE 4.1.2(a).7 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
60% GLASS(SS)/40% CALCINED WASTE 10°C; DIW

SR6-1 -2	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 77	DAY 87	DAY 93	DAY 103	DAY		
Si	<.02	.04±.02 .02±.02	<.02	<.02		±.02	
Ca	.188±.009 .113±.006	.146±.007 .136±.007	.160±.008 .125±.006	.132±.007 .223±.011		±.002	
Na							
Al	<.11	<.11	<.11	<.11		±.11	
Fe	<.01	<.01	<.01	<.01		±.01	
Ti	<.02	<.02	<.02	<.02		±.02	
Ag	<.05	<.05	<.05	<.05		±.05	5
As	<.08	<.08	<.08	<.08		±.08	5
B	<.07	<.07	<.07	<.07		±.07	500
Ba	<.004	<.004	<.004	<.004		±.004	100
Cd	<.01	<.01	<.01	<.01		±.01	.5
Co	<.01	<.01	<.01	<.01		±.01	-
Cr	<.007	<.007	<.007	<.007		±.007	5
Cu	<.02	<.02	<.02	<.02		±.02	
Hg	<.02	<.02	<.02	<.02		±.02	.1
Ni	<.02	<.02	<.02	<.02		±.02	
Pb	<.03	<.03	<.03	<.03		±.03	5
Se	<.07	<.07	<.07	<.07		±.07	1
U	<.5	<.5	<.5	<.5		±.5	2
Zn	.011±.006 .009±.006	.013±.006 .011±.006	.010±.006 .010±.006	.010±.006 .013±.006		±.006	

TABLE 4.1.2(a).8
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
60% GLASS (ss)/40% CALCINED WASTE 10°C; HAc

SR6-3 -4	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 7	DAY 14	DAY 21	DAY 28	DAY 35		
Si	<.02 <.02	.03 .04	.04 .04	.03 .04	.03 .02	±.02	
Ca	.026 .029	.053 .026	.062±.003 .046	.031 .026	.03 .03	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	<.01	<.01	<.01	<.01	<.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	<.07	.10 .10	.10 <.07	<.07	<.07	±.07	500
Ba	<.004	<.004	<.004	<.004	<.004	±.004	100
Cd	<.01	<.01	<.01	<.01	<.01	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	<.02	<.02	<.02	<.02	<.02	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	.04 <.03	<.03	<.03	<.03	<.03	±.03	5
Se	<.07	<.07	<.07	<.07	<.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	<.006	.012 <.006	.009 .007	<.006	<.006	±.006	

TABLE 4.1.2(a).8 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
60% GLASS (SS) /40% CALCINED WASTE 10°C; HAc

SR6-3 -4	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 42	DAY 49	DAY 56	DAY 64	DAY 70		
Si	.02±.02 .02±.02	<.02	<.02	<.02	<.02	±.02	
Ca	.022±.002 .014±.002	.058±.003 .111±.006	.035±.002 .052±.003	.104±.005 .041±.002	.155±.008 .070±.004	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	<.01	.026±.01 <.01	<.01	.012±.01 <.01	<.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	<.07	<.07	<.07	<.07	<.07	±.07	500
Ba	<.004	<.004	<.004	<.004	<.004	±.004	100
Cd	<.01	<.01	<.01	<.01	<.01	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	<.02	<.02	<.02	<.02	<.02	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	.04±.03 <.03	.05±.03 <.03	.03±.03 .04±.03	<.03	<.03	±.03	5
Se	<.07	<.07	<.07	<.07	<.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	<.006	.006±.006 <.006	<.006	.013±.006 .010±.006	.016±.006 .015±.006	±.006	

TABLE 4.1.2(a).8 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
60% GLASS/40% CALCINED WASTE 10°C; HAc

SR6-3 -4	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 77	DAY 87	DAY 93	DAY 103	DAY		
Si	<.02	<.02	<.02	<.02		±.02	
Ca	.124±.006 .166±.008	.087±.004 .033±.002	.153±.008 .099±.005	.116±.006 .046±.006		±.002	
Na							
Al	<.11	<.11	<.11	<.11		±.11	
Fe	<.01	<.01	<.01	<.01		±.01	
Ti	<.02	<.02	<.02	<.02		±.02	
Ag	<.05	<.05	<.05	<.05		±.05	5
As	<.08	<.08	<.08	<.08		±.08	5
B	<.07	<.07	<.07	<.07		±.07	500
Ba	<.004	<.004	<.004	<.004		±.004	100
Cd	<.01	<.01	<.01	<.01		±.01	.5
Co	<.01	<.01	<.01	<.01		±.01	-
Cr	<.007	<.007	<.007	<.007		±.007	5
Cu	<.02	<.02	<.02	<.02		±.02	
Hg	<.02	<.02	<.02	<.02		±.02	.1
Ni	<.02	<.02	<.02	<.02		±.02	
Pb	<.03	<.03	<.03	<.03		±.03	5
Se	<.07	<.07	<.07	<.07		±.07	1
U	<.5	<.5	<.5	<.5		±.5	2
Zn	.011±.006 .009±.006	.011±.006 <.006	.016±.006 .013±.006	.012±.006 .010±.006		±.006	

TABLE 4.1.2(b).1
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
90% GLASS/10% CALCINED WASTE 22.5°C; DIW

CW9-1 -2	SOLUTION CONCENTRATION (µg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 110	DAY 116	DAY 123	DAY 131	DAY 138		
Si	<.02	<.02	<.02	<.02	<.02	±.02	
Ca	<.002	<.002	<.002	<.002	<.002	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	<.01	<.01	<.01	<.01	<.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	<.07	<.07	<.07	<.07	<.07	±.07	500
Ba	<.004	<.004	<.004	<.004	<.004	±.004	100
Cd	<.01	<.01	<.01	<.01	<.01	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	<.02	<.02	<.02	<.02	<.02	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	<.03	<.03	<.03	.05±.03 <.03	.05±.03 <.03	±.03	5
Se	<.07	<.07	<.07	<.07	<.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	<.006	<.006	<.006	<.006	<.006	±.006	

TABLE 4.1.2(b).1 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
90% GLASS/10% CALCINED WASTE 22.5°C; DIW

CW9-1 -2	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 148	DAY 155	DAY 163	DAY 171	DAY 180		
Si	.06 .06	.07 .08	.05 .06	.07 .05	.06 .06	±.02	
Ca	.129±.006 .07 ±.004	.144±.007 .119±.006	.116±.006 .079±.004	.156±.008 .069±.003	.191±.009 .177±.008	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	<.01	<.01	<.01	<.01	<.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	<.07	<.07	<.07	<.07	<.07	±.07	500
Ba	<.004	<.004	<.004	<.004	<.004	±.004	100
Cd	<.01	<.01	<.01	<.01	<.01	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	<.02	<.02	<.02	<.02	<.02	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	<.03	<.03	<.03	<.03	<.03	±.03	5
Se	<.07	<.07	<.07	<.07	<.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	.016 .012	.019±.006 .025±.006	.014 .017	.017 .017	.025 .028	±.006	

TABLE 4.1.2(b).1 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
90% GLASS/10% CALCINED WASTE 22.5°C; DIW

CW9-1 -2	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 187	DAY 194					
Si	.04 .05	.03 .04				±.02	
Ca	.349±.017 .238±.009	.181±.009 .175±.009				±.002	
Na							
Al	<.11					±.11	
Fe	<.01	<.01				±.01	
Ti	<.02	<.02				±.02	
Ag	<.05	<.05				±.05	5
As	<.08	<.08				±.08	5
B	<.07	<.07				±.07	500
Ba	<.004	<.004				±.004	100
Cd	<.01	<.01				±.01	.5
Co	<.01	<.01				±.01	-
Cr	<.007	<.007				±.007	5
Cu	<.02	<.02				±.02	
Hg	<.02	<.02				±.02	.1
Ni	<.02	<.02				±.02	
Pb	<.03	<.03				±.03	5
Se	<.07	<.07				±.07	1
U	<.5	<.5	<.5	<.5		±.5	2
Zn	.02 .02	.035 .014	<.006	<.006	<.006	±.006	

TABLE 4.1.2(b).2
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
90% GLASS (SS)/10% CALCINED WASTE 22.5°C; DIW

SR9-1 -2	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 110	DAY 116	DAY 123	DAY 131	DAY 138		
Si	<.02	<.02	<.02	<.02	<.02	±.02	
Ca	<.002	<.002	<.002	<.002	<.002	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	<.01	<.01	<.01	<.01	<.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	<.07	<.07	<.07	<.07	<.07	±.07	500
Ba	.089±.004 .005±.004	<.004	<.004	<.004	<.004	±.004	100
Cd	<.01	<.01	<.01	<.01	<.01	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	<.02	<.02	<.02	<.02	<.02	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	<.03	<.03	<.03	<.03	<.03	±.03	5
Se	<.07	<.07	<.07	<.07	<.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	<.006	<.006	<.006	<.006	<.006	±.006	

TABLE 4.1.2(b).2 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
90% GLASS (SS)/10% CALCINED WASTE 22.5°C; DIW

SR9-1 -2	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 148	DAY 155	DAY 163	DAY 171	DAY 180		
Si	.06 .06	.05 .05	.04 .04	.05 .07	.05 .05	±.02	
Ca	.038 .063±.003	.169±.008 .118±.006	.028 .051±.003	.055±.003 .127±.006	.197±.01 .22 ±.011	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	<.01	<.01	<.01	<.01	<.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	<.07	<.07	<.07	<.07	<.07	±.07	500
Ba	<.004	<.004	<.004	<.004	<.004	±.004	100
Cd	<.01	<.01	<.01	<.01	<.01	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	<.02	<.02	<.02	<.02	<.02	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	<.03	<.03	<.03	.04±.03 <.03	<.03	±.03	5
Se	<.07	<.07	<.07	<.07	<.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	.010 .013	.011 .010	.009 .011	.016 .016	.02 .021	±.006	

TABLE 4.1.2(b).2 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
90% GLASS (SS)/10% CALCINED WASTE 22.5°C; DIW

SR9-1 -2	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (μg/mL)
	DAY 187	DAY 194					
Si	.05 .05	.03 .04				±.02	
Ca	.363±.018 .269±.013	.189±.009 .220±.011				±.002	
Na							
Al	<.11	<.11				±.11	
Fe	<.01	<.01				±.01	
Ti	<.02	<.02				±.02	
Ag	<.05	<.05				±.05	5
As	<.08	<.08				±.08	5
B	<.07	<.07				±.07	500
Ba	<.004	<.004				±.004	100
Cd	<.01	<.01				±.01	.5
Co	<.01	<.01				±.01	-
Cr	<.007	<.007				±.007	5
Cu	<.02	<.02				±.02	
Hg	<.02	<.02				±.02	.1
Ni	<.02	<.02				±.02	
Pb	<.03	<.03				±.03	5
Se	<.07	<.07				±.07	1
U	<.5	<.5				±.5	2
Zn	.02 .017	.012 .014				±.006	

TABLE 4.1.2(b).3
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
90% GLASS/10% CALCINED WASTE 22.5°C; HAc

CW9-3 -4	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 110	DAY 116	DAY 123	DAY 131	DAY 138		
Si	<.02	<.02	<.02	<.02	<.02	±.02	
Ca	<.002	<.002	<.002	<.002	<.002	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	<.01	<.01	<.01	<.01	<.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	<.07	<.07	<.07	<.07	<.07	±.07	500
Ba	<.004	<.004	<.004	<.004	<.004	±.004	100
Cd	<.01	<.01	<.01	<.01	<.01	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	<.02	<.02	<.02	<.02	<.02	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	<.03	<.03	<.03	<.03	<.03	±.03	5
Se	<.07	<.07	<.07	<.07	<.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	<.006	<.006	<.006	<.006	<.006	±.006	

TABLE 4.1.2(b).3 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
90% GLASS/10% CALCINED WASTE 22.5°C; HAc

CW9-3 -4	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 148	DAY 155	DAY 163	DAY 171	DAY 180		
Si	.05 .06	.04 .06	.03 .05	.05 .05	.05 .05	±.02	
Ca	.022±.002 .096±.005	.029±.002 .071±.004	.067±.003 .039±.002	.055±.003 .030±.002	.177±.009 .168±.008	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	<.01	<.01	<.01	<.01	<.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	<.07	<.07	<.07	<.07	<.07	±.07	500
Ba	<.004	<.004	<.004	<.004	<.004	±.004	100
Cd	<.01	<.01	<.01	<.01	<.01	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	<.02	<.02	<.02	<.02	<.02	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	<.03	<.03	<.03	<.03	<.03	±.03	5
Se	<.07	<.07	<.07	<.07	<.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	.008±.006 <.006	.01±.01 <.006	.007±.006 .008±.01	.009 <.006	.013 .013	±.006	

TABLE 4.1.2(b).3 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
90% GLASS/10% CALCINED WASTE 22.5°C; HAc

CW9-3 -4	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 187	DAY 194					
Si	.05 .04	.04 .03				±.02	
Ca	.179±.009 .199±.01	.159±.008 .129±.006				±.002	
Na							
Al	<.11	<.11				±.11	
Fe	<.01	<.01				±.01	
Ti	<.02	<.02				±.02	
Ag	<.05	<.05				±.05	5
As	<.08	<.08				±.08	5
B	<.07	<.07				±.07	500
Ba	<.004	<.004				±.004	100
Cd	<.01	<.01				±.01	.5
Co	<.01	<.01				±.01	-
Cr	<.007	<.007				±.007	5
Cu	<.02	<.02				±.02	
Hg	<.02	<.02				±.02	.1
Ni	<.02	<.02				±.02	
Pb	<.03	<.03				±.03	5
Se	<.07	<.07				±.07	1
U	<.5	<.5				±.5	2
Zn	.011 .012	.008 .009				±.006	

TABLE 4.1.2(b).4
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
90% GLASS (SS)/10% CALCINED WASTE 22.5°C; HAc

SR9-3 -4	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 110	DAY 116	DAY 123	DAY 131	DAY 138		
Si	<.02	<.02	<.02	.18±.02 <.02	<.02	±.02	
Ca	<.002	<.002	<.002	<.002	<.002	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	<.01	<.01	<.01	<.01	<.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	<.07	<.07	<.07	<.07	<.07	±.07	500
Ba	.005±.004 <.004	<.004	<.004	.011±.004 <.004	<.004	±.004	100
Cd	<.01	<.01	<.01	<.01	<.01	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	<.02	<.02	<.02	<.02	<.02	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	<.03	<.03	<.03	<.03	<.03	±.03	5
Se	<.07	<.07	<.07	<.07	<.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	<.006	<.006	<.006	<.006	<.006	±.006	

TABLE 4.1.2(b).4 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
90% GLASS (SS)/10% CALCINED WASTE 22.5°C; HAc

SR9-3 -4	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LECHATE TOXIC CRITERIA (ug/ml)
	DAY 148	DAY 155	DAY 163	DAY 171	DAY 180		
Si	.010 .04	.16 .03	.16 .04	.16 .05	.15 .05	±.02	
Ca	.025±.002 .029±.002	.036 .043	.028±.002 .073±.002	.064±.003 .088±.004	.196±.01 .210±.011	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	<.01	<.01	<.01	<.01	<.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	<.07	<.07	<.07	<.07	<.07	±.07	500
Ba	<.004	<.004	<.004	<.004	<.004	±.004	100
Cd	<.01	<.01	<.01	<.01	<.01	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	<.02	<.02	<.02	<.02	<.02	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	<.03	<.03	<.03	<.03	<.03	±.03	5
Se	<.07	<.07	<.07	<.07	<.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	.006±.006 <.006	<.006	.009±.006 <.006	.01 .008	.011 .015	±.006	

TABLE 4.1.2(b).4 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
90% GLASS (SS)/10% CALCINED WASTE 22.5°C; HAc

UTION CONCENTRATION (µg/mL)				ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
Y 194					
4)4				±.02	
36±.012 71±.009				±.002	
11				±.11	
01				±.01	
02				±.02	
05				±.05	5
08				±.08	5
07				±.07	500
004				±.004	100
01				±.01	.5
01				±.01	-
.007				±.007	5
.02				±.02	
.02				±.02	.1
.02				±.02	
.03				±.03	5
.07				±.07	1
.5				±.5	2
.009 .010				±.006	

TABLE 4.1.2(b).5
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
60% GLASS/40% CALCINED WASTE 22.5°C; DIW

CW6-1 -2	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 110	DAY 116	DAY 123	DAY 131	DAY 138		
Si	<.02	<.02	<.02	<.02	<.02	±.02	
Ca	<.002	<.002	<.002	<.002	<.002	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	<.01	<.01	<.01	.017±.01 <.01	<.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	<.07	<.07	<.07	<.07	<.07	±.07	500
Ba	<.004	<.004	<.004	<.004	<.004	±.004	100
Cd	<.01	<.01	<.01	<.01	<.01	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	<.02	<.02	<.02	<.02	<.02	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	<.03	<.03	<.03	<.03	.04±.03 <.03	±.03	5
Se	<.07	<.07	<.07	<.07	<.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	<.006	<.006	<.006	<.006	<.006	±.006	

TABLE 4.1.2(b).5 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
60% GLASS/40% CALCINED WASTE 22.5°C; DIW

CW6-1 -2	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 148	DAY 155	DAY 163	DAY 171	DAY 180		
Si	.07 .06	.08 .07	.05 .06	.06 .07	.05 .07	±.02	
Ca	.072±.004 .056±.003	.122±.006 .070±.004	.061±.003 .048±.002	.077±.004 .044±.002	.185±.009 .159±.008	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	<.01	<.01	<.01	<.01	<.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	<.07	<.07	<.07	<.07	<.07	±.07	500
Ba	<.004	<.004	<.004	<.004	<.004	±.004	100
Cd	<.01	<.01	<.01	<.01	<.01	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	<.02	<.02	<.02	<.02	<.02	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	<.03	<.03	<.03	<.03	<.03	±.03	5
Se	<.07	<.07	<.07	<.07	<.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	.016 .015	.022 .017	.014 .015	.015 .013	.026 .020	±.006	

TABLE 4.1.2(b).5 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
60% GLASS/40% CALCINED WASTE 22.5°C; DIW

CW6-1 -2	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 187	DAY 194					
Si	.04 .05	.04 .04				±.02	
Ca	.257±.013 .248±.012	.257±.013 .164±.008				±.002	
Na							
Al	<.11	<.11				±.11	
Fe	<.01	<.01				±.01	
Ti	<.02	<.02				±.02	
Ag	<.05	<.05				±.05	5
As	<.08	<.08				±.08	5
B	<.07	<.07				±.07	500
Ba	<.004	<.004				±.004	100
Cd	<.01	<.01				±.01	.5
Co	<.01	<.01				±.01	-
Cr	<.007	<.007				±.007	5
Cu	<.02	<.02				±.02	
Hg	<.02	<.02				±.02	.1
Ni	<.02	<.02				±.02	
Pb	<.03	<.03				±.03	5
Se	<.07	<.07				±.07	1
U	<.5	<.5				±.5	2
Zn	.020 .016	.012 .012				±.006	

TABLE 4.1.2(b).6

LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
60% GLASS (SS)/40% CALCINED WASTE 22.5°C; DIW

SR6-1 -2	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 110	DAY 116	DAY 123	DAY 131	DAY 138		
Si	<.02	<.02	<.02	<.02	<.02	±.02	
Ca	<.002	<.002	<.002	<.002	<.002	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	<.01	<.01	<.01	<.01	<.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	<.07	<.07	<.07	<.07	<.07	±.07	500
Ba	<.004	<.004	<.004	<.004	<.004	±.004	100
Cd	<.01	<.01	<.01	<.01	<.01	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	<.02	<.02	<.02	<.02	<.02	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	<.03	<.03	<.03	<.03	<.03	±.03	5
Se	<.07	<.07	<.07	<.07	<.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	<.006	<.006	<.006	<.006	<.006	±.006	

TABLE 4.1.2(b).6 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
60% GLASS (SS)/40% CALCINED WASTE 22.5°C; DIW

SR6-1 -2	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 148	DAY 155	DAY 163	DAY 171	DAY 180		
Si	.06 .07	.06 .06	.04 .05	.05 .06	.06 .06	±.02	
Ca	.047 .074±.004	.046 .098±.005	.041 .056±.003	.060±.003 .081±.004	.200±.01 .173±.009	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	<.01	<.01	<.01	<.01	<.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	<.07	<.07	<.07	<.07	<.07	±.07	500
Ba	<.004	<.004	<.004	<.004	<.004	±.004	100
Cd	<.01	<.01	<.01	<.01	<.01	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	–
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	<.02	<.02	<.02	<.02	<.02	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	<.03	<.03	<.03	<.03	<.03	±.03	5
Se	<.07	<.07	<.07	<.07	<.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	.011 .010	.009 .010	.010 .009	.013 .012	.018 .017	±.006	

TABLE 4.1.2(b).6 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
60% GLASS (SS)/40% CALCINED WASTE 22.5°C; DIW

SR6-1 -2	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 187	DAY 194					
Si	.04 .05	.04 .05				±.02	
Ca	.224±.011 .208±.01	.189±.009 .321±.016				±.002	
Na							
Al	<.11	<.11				±.11	
Fe	<.01	<.01				±.01	
Ti	<.02	<.02				±.02	
Ag	<.05	<.05				±.05	5
As	<.08	<.08				±.08	5
B	<.07	<.07				±.07	500
Ba	<.004	<.004				±.004	100
Cd	<.01	<.01				±.01	.5
Co	<.01	<.01				±.01	-
Cr	<.007	<.007				±.007	5
Cu	<.02	<.02				±.02	
Hg	<.02	<.02				±.02	.1
Ni	<.02	<.02				±.02	
Pb	<.03	<.03				±.03	5
Se	<.07	<.07				±.07	1
U	<.5	<.5				±.5	2
Zn	.014 .013	.011 .017				±.006	

TABLE 4.1.2(b).7
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
60% GLASS/40% CALCINED WASTE 22.5°C; HAc

CW6-3 -4	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 110	DAY 116	DAY 123	DAY 131	DAY 138		
Si	<.02	<.02	<.02	<.02	<.02	±.02	
Ca	<.002	<.002	<.002	<.002	<.002	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	<.01	<.01	<.01	<.01	<.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	<.07	<.07	<.07	<.07	<.07	±.07	500
Ba	<.004	<.004	<.004	.006±.004 <.004	<.004	±.004	100
Cd	<.01	<.01	<.01	<.01	<.01	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	<.02	<.02	<.02	<.02	<.02	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	<.03	<.03	<.03	<.03	<.03	±.03	5
Se	<.07	<.07	<.07	<.07	<.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	.011±.006 .011±.006	<.006	<.006	<.006	<.006	±.006	

TABLE 4.1.2(b).7 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
60% GLASS/40% CALCINED WASTE 22.5°C; HAc

CW6-3 -4	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 148	DAY 155	DAY 163	DAY 171	DAY 180		
Si	.07 .06	.06 .06	.06 .05	.07 .06	.07 .06	±.02	
Ca	.05±.003 .081±.004	.058±.003 .026±.002	.032±.002 .068±.003	.023 .044	.158±.008 .161±.008	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	<.01	<.01	<.01	<.01	<.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	<.07	<.07	<.07	<.07	<.07	±.07	500
Ba	<.004	<.004	<.004	<.004	<.004	±.004	100
Cd	<.01	<.01	<.01	<.01	<.01	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	<.02	<.02	<.02	<.02	<.02	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	<.03	<.03	<.03	<.03	<.03	±.03	5
Se	<.07	<.07	<.07	<.07	<.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	<.006	<.006	.011 .011	.008 .011	.014 .012	±.006	

TABLE 4.1.2(b).7 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
60% GLASS/40% CALCINED WASTE 22.5°C; HAc

CW6-3 -4	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 187	DAY 194					
Si	.05 .06	.05 .04				±.02	
Ca	.271±.014 .49 ±.02	.196±.010 .160±.020				±.02	
Na							
Al	<.11	<.11				±.11	
Fe	<.01	<.01				±.01	
Ti	<.02	<.02				±.02	
Ag	<.05	<.05				±.05	5
As	<.08	<.08				±.08	5
B	<.07	<.07				±.07	500
Ba	<.004	<.004				±.004	100
Cd	<.01	<.01				±.01	.5
Co	<.01	<.01				±.01	-
Cr	<.007	<.007				±.007	5
Cu	<.02	<.02				±.02	
Hg	<.02	<.02				±.02	.1
Ni	<.02	<.02				±.02	
Pb	<.03	<.03				±.03	5
Se	<.07	<.07				±.07	1
U	<.5	<.5				±.5	2
Zn	.014 .021	.010 .007				±.006	

TABLE 4.1.2(b).8

LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:

60% GLASS (SS)/40% CALCINED WASTE 22.5°C; HAc

SR6-3 -4	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 110	DAY 116	DAY 123	DAY 131	DAY 138		
Si	<.02	<.02	<.02	<.02	<.02	±.02	
Ca	<.002	<.002	<.002	<.002	<.002	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	<.01	<.01	<.01	<.01	<.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	<.07	<.07	<.07	<.07	<.07	±.07	500
Ba	<.004	<.004	<.004	<.004	<.004	±.004	100
Cd	<.01	<.01	<.01	<.01	<.01	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	<.02	<.02	<.02	<.02	<.02	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	<.03	<.03	<.03	<.03	<.03	±.03	5
Se	<.07	<.07	<.07	<.07	<.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	<.006	<.006	<.006	<.006	<.006	±.006	

TABLE 4.1.2(b).8 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
60% GLASS (SS)/40% CALCINED WASTE 22.5°C; HAc

SR6-3 -4	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 148	DAY 155	DAY 163	DAY 171	DAY 180		
Si	.08 .08	.07 .07	.06 .06	.07 .08	.07 .08	±.02	
Ca	.094±.005 .024±.002	.108±.005 .037±.002	.162±.008 .023±.002	.059±.003 .049±.002	.167±.008 .151±.002	±.002	
Na							
Al	<.11	<.11	<.11	<.11	<.11	±.11	
Fe	<.01	<.01	<.01	<.01	<.01	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	<.08	<.08	<.08	<.08	<.08	±.08	5
B	<.07	<.07	<.07	<.07	<.07	±.07	500
Ba	<.004	<.004	<.004	<.004	<.004	±.004	100
Cd	<.01	<.01	<.01	<.01	<.01	±.01	.5
Co	<.01	<.01	<.01	<.01	<.01	±.01	-
Cr	<.007	<.007	<.007	<.007	<.007	±.007	5
Cu	<.02	<.02	<.02	.03±.02 <.02	<.02	±.02	
Hg	<.02	<.02	<.02	<.02	<.02	±.02	.1
Ni	<.02	<.02	<.02	<.02	<.02	±.02	
Pb	<.03	<.03	<.03	<.03	<.03	±.03	5
Se	<.07	<.07	<.07	<.07	<.07	±.07	1
U	<.5	<.5	<.5	<.5	<.5	±.5	2
Zn	.010 <.006	.013 <.006	.008 <.006	.024 .007	.009 <.006	±.006	

TABLE 4.1.2(b).8 Continued
LONG-TERM LEACH TEST SOLUTION CONCENTRATIONS FOR:
60% GLASS (SS)/40% CALCINED WASTE 22.5°C; HAc

SR6-3 -4	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	DAY 187	DAY 194					
Si	.06 .06	.05 .07				±.02	
Ca	.192±.01 .211±.011	.171±.009 .207±.010				±.002	
Na							
Al	<.11	<.11				±.11	
Fe	<.01	<.01				±.01	
Ti	<.02	<.02				±.02	
Ag	<.05	<.05				±.05	5
As	<.08	<.08				±.08	5
B	<.07	<.07				±.07	500
Ba	<.004	<.004				±.004	100
Cd	<.01	<.01				±.01	.5
Co	<.01	<.01				±.01	-
Cr	<.007	<.007				±.007	5
Cu	<.02	<.02				±.02	
Hg	<.02	<.02				±.02	.1
Ni	<.02	<.02				±.02	
Pb	<.03	<.03				±.03	5
Se	<.07	<.07				±.07	1
U	<.5	<.5				±.5	2
Zn	.008 .012	.007 .010				±.006	

TABLE 4.1.3.1

ACTIVITIES AND DIMENSIONS OF SPECIMENS
USED IN RADIOACTIVE RELEASE EXPERIMENTS

SPECIMEN NUMBER	TOTAL ACTIVITY (Bq)		SPECIMEN SURFACE AREA (cm^2)	SPECIMEN WEIGHT (g)	SPECIFIC ^{137}Cs ACTIVITY (Bq/g)
	^{137}Cs	^{60}Co			
60-1	2.84×10^6	4.1×10^6	4.877	1.261	2.25×10^6
60-2	1.37×10^6	2.18×10^6	4.281	1.233	1.11×10^6
60-3	4.75×10^6	6.41×10^6	4.755	1.459	3.26×10^6
60-4	6.43×10^6	8.53×10^6	3.877	1.516	4.24×10^6
90-1	2.94×10^6	3.63×10^6	2.740	0.699	4.20×10^6
90-2	1.36×10^6	1.97×10^6	2.789	0.726	1.87×10^6
90-3	1.02×10^6	1.70×10^6	1.866	0.468	2.18×10^6
90-4	1.12×10^6	1.60×10^6	3.797	0.781	1.43×10^6
Mean Values:			3.63		2.57×10^6

TABLE 4.1.3.2
LONG-TERM LEACH TEST: ACTIVITY RELEASE FOR:
90% GLASS/10% CALCINED WASTE; 10°C; DIW

DAY	SAMPLE	^{137}Cs Activity(Bq)	2S%	^{60}Co Activity(Bq)	2S%
7	1	13.6	26	21.1	18
	2	2.52	55	6.20	34
13	1	3.90	56	6.69	33
	2	1.92	76	ND	
21	1	31.5	14	34.0	16
	2	2.08	82	ND	
28	1	12.0	16	11.9	16
	2	1.73	76	1.66	53
35	1	147	5	186	5
	2	2.34	44	2.53	34
45	1	2.23	38	1.69	57
	2	ND		1.42	76
52	1	4.59	27	6.04	22
	2	0.791	87	ND	
60	1	ND		ND	
	2	2.84	55	3.71	61
68	1	ND		ND	
	2	ND		ND	
72	1	2.57	56	1.98	70
	2	1.05	82	ND	
79	1	ND		ND	
	2	13.7	16	ND	
86	1	ND		ND	
	2	ND		ND	

TABLE 4.1.3.2 Continued
LONG-TERM LEACH TEST: ACTIVITY RELEASE FOR:
90% GLASS/10% CALCINED WASTE; 10°C; DIW

DAY	SAMPLE	^{137}Cs Activity(Bq)	2S%	^{60}Co Activity(Bq)	2S%
93	1	1.18	92	ND	
	2	0.755	92	ND	
100	1	ND		ND	
	2	ND		ND	
107	1	ND		ND	
	2	ND		ND	
114	1	ND		ND	
	2	ND		ND	
121	1	ND		ND	
	2	ND		ND	
128	1	1.70	70	5.37	36
	2	ND		ND	
135	1	1.61	70	ND	
	2	ND		ND	
141	1	ND		ND	
	2	ND		ND	
149	1	ND		ND	
	2	ND		ND	
156	1	ND		0.603	90
	2	ND		ND	
163	1	2.89	41	2.52	56
	2	ND		ND	
172	1	0.646	90	ND	
	2	ND		ND	

TABLE 4.1.3.2 Continued
LONG-TERM LEACH TEST: ACTIVITY RELEASE FOR:
90% GLASS/10% CALCINED WASTE; 10°C; DIW

DAY	SAMPLE	^{137}Cs Activity(Bq)	2S%	^{60}Co Activity(Bq)	2S%
178	1	ND		ND	
	2	ND		ND	
185	1	ND		ND	
	2	ND		ND	
195	1	ND		ND	
	2	ND		ND	
	1				
	2				
	1				
	2				
	1				
	2				
	1				
	2				
	1				
	2				
	1				
	2				
	1				
	2				
	1				
	2				
	1				
	2				

TABLE 4.1.3.3
LONG-TERM LEACH TEST: ACTIVITY RELEASE FOR:
90% GLASS/10% CALCINED WASTE; 10°C; HAc

DAY	SAMPLE	^{137}Cs Activity(Bq)	2S%	^{60}Co Activity(Bq)	2S%
7	3	11.8	29	18.8	22
	4	3.64	76	5.73	59
13	3	50.3	11	52.4	13
	4	21.5	18	40	13
21	3	1.45	92	ND	
	4	2.47	81	ND	
28	3	5.56	22	6.05	26
	4	1.12	59	ND	
35	3	2.51	48	4.00	26
	4	1.20	67	0.778	84
45	3	2.13	41	2.23	38
	4	1.78	47	ND	
52	3	6.48	25	22.9	12
	4	ND		ND	
60	3	2.12	63	4.52	34
	4	1.81	80	1.78	84
68	3	8.30	28	17.2	18
	4	ND		ND	
72	3	245	5	252	5
	4	ND		ND	
79	3	1130	5	3640	5
	4	0.52	90	ND	
86	3	0.892	90	ND	
	4	0.726	90	ND	

TABLE 4.1.3.3 Continued
LONG-TERM LEACH TEST: ACTIVITY RELEASE FOR:
90% GLASS/10% CALCINED WASTE; 10°C; HAc

DAY	SAMPLE	^{137}Cs Activity(Bq)	2S%	^{60}Co Activity(Bq)	2S%
93	1	10.00	21	14.1	23
	2	ND		ND	
100	1	ND		ND	
	2	ND		ND	
107	1	ND		ND	
	2	0.965	92	ND	
114	1	ND		ND	
	2	ND		ND	
121	1	ND		1.59	63
	2	ND		ND	
128	1	ND		ND	
	2	ND		ND	
135	1	ND		ND	
	2	ND		ND	
141	1	3.33	48	3.83	51
	2	ND		ND	
149	1	ND		ND	
	2	ND		ND	
156	1	ND		ND	
	2	0.789	90	ND	
163	1	1.26	82	1.70	46
	2	ND		ND	
172	1	2.47	38	3.86	27
	2	ND		ND	

TABLE 4.1.3.3 Continued
LONG-TERM LEACH TEST: ACTIVITY RELEASE FOR:
90% GLASS/10% CALCINED WASTE; 10°C; HAc

DAY	SAMPLE	^{137}Cs Activity(Bq)	2S%	^{60}Co Activity(Bq)	2S%
178	1	74.2	7	63.1	8
	2	ND		ND	
185	1	119	5	105	7
	2	ND		ND	
195	1	1.69	68	ND	
	2	ND		ND	
	1				
	2				
	1				
	2				
	1				
	2				
	1				
	2				
	1				
	2				
	1				
	2				
	1				
	2				
	1				
	2				
	1				
	2				

TABLE 4.1.3.4
LONG-TERM LEACH TEST: ACTIVITY RELEASE FOR:
60% GLASS/40% CALCINED WASTE; 10°C; DIW

DAY	SAMPLE	^{137}Cs Activity(Bq)	2S%	^{60}Co Activity(Bq)	2S%
7	1	4.19	52	4.73	39
	2	4.05	40	6.17	37
13	1	3.62	50	6.20	39
	2	1.54	94	3.25	80
21	1	5.40	44	5.67	58
	2	1.66	92	2.39	92
28	1	3.11	35	8.48	19
	2	1.31	74	1.79	63
35	1	2.65	45	5.49	29
	2	1.12	69	1.56	51
45	1	1.84	52	6.22	21
	2	ND		ND	
52	1	1.36	78	5.78	24
	2	0.554	92	ND	
60	1	ND		3.06	63
	2	ND		ND	
68	1	1.65	82	3.46	50
	2	ND		ND	
72	1	ND		4.50	43
	2	3.14	46	ND	
79	1	ND		3.70	37
	2	ND		1.17	61
86	1	ND		3.14	35
	2	ND		ND	

TABLE 4.1.3.4 Continued
LONG-TERM LEACH TEST: ACTIVITY RELEASE FOR:
60% GLASS/40% CALCINED WASTE; 10°C: DIW

DAY	SAMPLE	^{137}Cs Activity(Bq)	2S%	^{60}Co Activity(Bq)	2S%
93	1	ND		ND	
	2	ND		ND	
100	1	ND		ND	
	2	ND		ND	
107	1	1.10	92	ND	
	2	ND		ND	
114	1	ND		ND	
	2	ND		ND	
121	1	ND		ND	
	2	ND		ND	
128	1	ND		ND	
	2	ND		ND	
135	1	ND		ND	
	2	ND		2.30	62
141	1	ND		ND	
	2	ND		ND	
149	1	ND		ND	
	2	ND		ND	
156	1	0.801	90	ND	
	2	ND		ND	
163	1	ND		ND	
	2	ND		ND	
172	1	ND		ND	
	2	ND		ND	

TABLE 4.1.3.4 Continued
LONG-TERM LEACH TEST: ACTIVITY RELEASE FOR:
60% GLASS/40% CALCINED WASTE; 10°C; DIW

DAY	SAMPLE	^{137}Cs Activity(Bq)	2S%	^{60}Co Activity(Bq)	2S%
178	1	ND		ND	
	2	ND		ND	
185	1	ND		ND	
	2	ND		ND	
195	1	ND		ND	
	2	ND		ND	
	1				
	2				
	1				
	2				
	1				
	2				
	1				
	2				
	1				
	2				
	1				
	2				
	1				
	2				
	1				
	2				
	1				
	2				

TABLE 4.1.3.5
LONG-TERM LEACH TEST: ACTIVITY RELEASE FOR:
60% GLASS/40% CALCINED WASTE; 10°C; HAc

DAY	SAMPLE	^{137}Cs Activity(Bq)	2S%	^{60}Co Activity(Bq)	2S%
7	3	5.74	44	15.6	27
	4	18.1	19	27.2	21
13	3	6.63	35	13.1	23
	4	13.6	23	19.6	19
21	3	5.52	42	4.36	74
	4	6.34	37	11.4	30
28	3	3.79	34	4.11	29
	4	3.94	31	4.41	25
35	3	2.12	55	2.95	45
	4	3.49	31	2.71	48
45	3	2.35	45	1.71	52
	4	2.63	41	2.42	40
52	3	1.78	43	ND	
	4	1.30	65	1.34	65
60	3	ND		ND	
	4	ND		ND	
68	3	ND		ND	
	4	1.17	92	ND	
72	3	1.61	78	ND	
	4	0.886	90	ND	
79	3	ND		ND	
	4	ND		ND	
86	3	ND		ND	
	4	ND		ND	

TABLE 4.1.3.5 Continued
LONG-TERM LEACH TEST: ACTIVITY RELEASE FOR:
60% GLASS/40% CALCINED WASTE; 10°C; HAc

DAY	SAMPLE	^{137}Cs Activity(Bq)	2S%	^{60}Co Activity(Bq)	2S%
93	1	ND		ND	
	2	1.22	92	ND	
100	1	ND		ND	
	2	ND		ND	
107	1	ND		ND	
	2	ND		ND	
114	1	ND		ND	
	2	0.828	92	ND	
121	1	ND		ND	
	2	ND		ND	
128	1	ND		ND	
	2	ND		ND	
135	1	ND		ND	
	2	ND		ND	
141	1	ND		ND	
	2	ND		ND	
149	1	ND		ND	
	2	ND		ND	
156	1	0.975	87	ND	
	2	0.923	90	ND	
163	1	0.701	90	ND	
	2	ND		ND	
172	1	0.706	90	ND	
	2	0.660	90	ND	

TABLE 4.1.3.5 Continued
LONG-TERM LEACH TEST: ACTIVITY RELEASE FOR:
60% GLASS/40% CALCINED WASTE; 10°C; HAc

DAY	SAMPLE	^{137}Cs Activity(Bq)	2S%	^{60}Co Activity(Bq)	2S%
178	1	ND		ND	
	2	ND		ND	
185	1	ND		ND	
	2	ND		ND	
195	1	1.19	94	ND	
	2	ND		ND	
	1				
	2				
	1				
	2				
	1				
	2				
	1				
	2				
	1				
	2				
	1				
	2				
	1				
	2				
	1				
	2				
	1				
	2				

TABLE 4.1.3.6
LONG-TERM LEACH TEST: ACTIVITY RELEASE FOR:
90% GLASS/10% CALCINED WASTE; 22.5°C; DIW

DAY	SAMPLE	^{137}Cs Activity(Bq)	2S%	^{60}Co Activity(Bq)	2S%
202	1	0.929	95	ND	
	2	1.27	91	ND	
212	1	1.25	89	ND	
	2	ND		ND	
220	1	ND		ND	
	2	0.655	95	ND	
227	1	ND		ND	
	2	ND		ND	
234	1	1.06	94	ND	
	2	ND		ND	
241	1	ND		1.64	52
	2	1.54	55		
251	1	2.96	41	3.39	27
	2	0.917	90	ND	
258	1	8.94	19	11.5	16
	2	1.21	82	2.11	55
268	1	0.822	82	ND	
	2	ND		ND	
279	1	ND		ND	
	2	ND		ND	
290	1	ND		ND	
	2	1.26	64	ND	
301	1	ND		ND	
	2	0.820	90	ND	

TABLE 4.1.3.6 Continued
LONG-TERM LEACH TEST: ACTIVITY RELEASE FOR:
90% GLASS/10% CALCINED WASTE; 22.5°C; DIW

DAY	SAMPLE	^{137}Cs Activity(Bq)	2S%	^{60}Co Activity(Bq)	2S%
311	3	0.871	99	ND	
	4	ND		ND	
321	3	0.987	78	ND	
	4	ND		ND	
332	3	1.60	80	3.48	38
	4	0.708	95	ND	
341	3	ND		ND	
	4	0.942	82	ND	
351	3	ND		ND	
	4	ND		ND	
361	3	2.61	44	4.18	36
	4	1.39	45	ND	
371	3	ND		ND	
	4	0.622	95	ND	
381	3	ND		ND	
	4	ND		ND	
	3				
	4				
	3				
	4				
	3				
	4				
	3				
	4				

TABLE 4.1.3.7
LONG-TERM LEACH TEST: ACTIVITY RELEASE FOR:
90% GLASS/10% CALCINED WASTE; 22.5°C; HAc

DAY	SAMPLE	^{137}Cs Activity(Bq)	2S%	^{60}Co Activity(Bq)	2S%
202	3	ND		ND	
	4	ND		ND	
212	3	2.30	58	3.39	46
	4	37.1	11	44.7	10
220	3	ND		ND	
	4	ND		ND	
227	3	ND		ND	
	4	0.695	95	ND	
234	3	2.63	46	2.36	48
	4	ND		ND	
241	3	1.76	68	2.74	34
	4	ND		ND	
251	3	3.48	34	7.72	20
	4	3.82	28	1.41	64
258	3	ND		ND	
	4	ND		ND	
268	3	ND		ND	
	4	ND		ND	
279	3	ND		ND	
	4	ND		ND	
290	3	ND		ND	
	4	ND		ND	
301	3	ND		ND	
	4	ND		ND	

TABLE 4.1.3.7 Continued
LONG-TERM LEACH TEST: ACTIVITY RELEASE FOR:
90% GLASS/10% CALCINED WASTE; 22.5°C; HAc

DAY	SAMPLE	^{137}Cs Activity(Bq)	2S%	^{60}Co Activity(Bq)	2S%
311	3	ND		ND	
	4	ND		ND	
321	3	ND		ND	
	4	ND		ND	
332	3	ND		ND	
	4	ND		ND	
341	3	ND		ND	
	4				
351	3	ND		ND	
	4	ND		ND	
361	3	1.18	80	ND	
	4	ND		ND	
371	3	ND		ND	
	4	ND		ND	
381	3	ND		ND	
	4	ND		ND	
	3				
	4				
	3				
	4				
	3				
	4				
	3				
	4				

TABLE 4.1.3.8
LONG-TERM LEACH TEST: ACTIVITY RELEASE FOR:
60% GLASS/40% CALCINED WASTE; 22.5°C; DIW

DAY	SAMPLE	^{137}Cs Activity(Bq)	2S%	^{60}Co Activity(Bq)	2S%
202	1	ND		1.09	95
	2	ND		ND	
212	1	ND		2.71	67
	2	ND		ND	
220	1	0.884	95	1.92	62
	2	ND		ND	
227	1	ND		1.58	61
	2	ND		ND	
234	1	ND		1.71	22
	2	ND		ND	
241	1	0.749	96	2.19	43
	2	ND		ND	
251	1	ND		0.728	90
	2	ND		ND	
258	1	1.22	76	ND	
	2	ND		ND	
268	1	ND		ND	
	2	ND		ND	
279	1	ND		ND	
	2	ND		ND	
290	1	ND		ND	
	2	ND		ND	
301	1	ND		ND	
	2	ND		ND	

TABLE 4.1.3.8 Continued
LONG-TERM LEACH TEST: ACTIVITY RELEASE FOR:
60% GLASS/40% CALCINED WASTE; 22.5°C; DIW

DAY	SAMPLE	^{137}Cs Activity(Bq)	2S%	^{60}Co Activity(Bq)	2S%
311	3	ND		ND	
	4	ND		ND	
321	3	ND		ND	
	4	ND		ND	
332	3	1.13	93	1.20	77
	4	ND		ND	
341	3	ND		ND	
	4	1.22	95	ND	
351	3	ND		ND	
	4	0.907	96	ND	
361	3	ND		ND	
	4	ND		ND	
371	3	ND		ND	
	4	ND		ND	
381	3	ND		ND	
	4	ND		ND	
	3				
	4				
	3				
	4				
	3				
	4				
	3				
	4				

TABLE 4.1.3.9
LONG-TERM LEACH TEST: ACTIVITY RELEASE FOR:
60% GLASS/40% CALCINED WASTE; 22.5°C; HAc

DAY	SAMPLE	^{137}Cs Activity(Bq)	2S%	^{60}Co Activity(Bq)	2S%
202	3	1.33	94	0.853	95
	4	ND		ND	
212	3	ND		ND	
	4	0.995	95	ND	
220	3	ND		ND	
	4	2.16	65	3.35	43
227	3	0.878	95	ND	
	4	0.788	95	1.90	42
234	3	ND		1.38	43
	4	1.38	69	1.25	55
241	3	0.56	95	ND	
	4	0.99	92	1.99	35
251	3	3.00	47	ND	
	4	1.60	86	ND	
258	3	ND		ND	
	4	ND		ND	
268	3	ND		ND	
	4	ND		ND	
279	3	ND		ND	
	4	0.816	90	ND	
290	3	1.08	90	ND	
	4	ND		ND	
301	3	1.09	90	ND	
	4	ND		ND	

TABLE 4.1.3.9 Continued
LONG-TERM LEACH TEST: ACTIVITY RELEASE FOR:
60% GLASS/40% CALCINED WASTE; 22.5°C; HAc

DAY	SAMPLE	^{137}Cs Activity(Bq)	2S%	^{60}Co Activity(Bq)	2S%
311	3	ND		ND	
	4	ND		ND	
321	3	ND		ND	
	4	ND		ND	
332	3	ND		ND	
	4	1.13	95	0.844	85
341	3	ND		ND	
	4	1.86	52	ND	
351	3	ND		ND	
	4	ND		ND	
361	3	ND		ND	
	4	ND		ND	
371	3	1.23	96	ND	
	4			ND	
381	3	1.34	96	ND	
	4	ND		ND	
	3				
	4				
	3				
	4				
	3				
	4				
	3				
	4				

TABLE 4.2(a)
LEACHATE COMPOSITIONS RESULTING
FROM EXTRACTION IN HAc; 10°C

	SOLUTION CONCENTRATIONS (μg/mL)						ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	RAW WASTE		WASTE CALCINED 1400°C		60% GLASS/40% WASTE		
	#1	#2	#1	#2	#1	#2	
Si	1.47±.07	1.32±.07	1.18±.06	0.39±.02	1.21±.06	1.30±.07	
Ca	33.3±1.7	34.3±1.7	1.38±.07	0.63±.03	2.76±.14	3.01±.15	
Na							
Al	<.11	<.11	<.11	<.11	.24±.11	.20.11	
Fe	.012±.01	<.01	.343±.017	.092±.01	.104±.01	.63±.03	
Ti	.03±.02	<.02	<.02	<.02	.03±.02	.02±.02	
Ag	.017±.01	.016±.01	<.01	<.01	<.01	<.01	5
As	215±11	207±10	<.08	<.08	<.08	<.08	5
B	91±5	91±5	.08±.07	<.07	<.07	<.07	500
Ba	224±11	228±11	.262±.013	.119±.006	.021±.004	.073±.004	100
Cd	242±12	247±12	.249±.012	.087±.01	.057±.01	.101±.01	.5
Co	8.7±.4	8.2±.4	.084±.01	.04±.01	.078±.01	.105±.01	
Cr	.012±.007	.012±.007	<.007	<.007	.013±.007	.010±.007	5
Cu	.15±.02	.15±.02	.27±.02	.16±.02	.05±.02	.19±.02	
Hg	222±11	223±11	<.02	<.02	<.02	<.02	.1
Ni	.31±.02	.27±.02	.07±.02	.04±.02	.07±.02	.09±.02	
Pb	1.61±.08	1.55±.08	<.03	<.03	.07±.03	.07±.03	5
Se	55±3	58±3	<.07	<.07	<.07	<.07	1
U	1.1±.5	0.7±.5	<.5	<.5	<.5	<.5	2
Zn	322±16	326±16	.168±.008	.105±.006			

TABLE 4.2(a) Continued
LEACHATE COMPOSITIONS RESULTING
FROM EXTRACTION IN HAc; 10°C

	SOLUTION CONCENTRATIONS (μg/mL)						ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	60% GLASS (SS)/ 40% WASTE		90% GLASS/ 10% WASTE		90% GLASS (SS)/ 10% WASTE		
	#1	#2	#1	#2	#1	#2	
Si	.82±.04	.91±.05	.68±.03	.53±.03	.70±.04	.95±.05	
Ca	1.53±.08	2.26±.11	.89±.04	.53±.03	.59±.03	.75±.04	
Na							
Al	.29±.11	<.11	<.11	<.11	<.11	.21±.11	
Fe	.25±.013	.217±.011	.06±.01	<.01	.235±.212	277±.214	
Ti	.02±.02	<.02	<.02	<.02	<.02	<.02	
Ag	.082±.01	<.01	<.01	<.01	.013±.01	.01±.01	5
As	<.08	<.08	<.08	<.08	<.08	<.08	5
B	<.07	<.07	<.07	<.07	<.07	<.07	500
Ba	.052±.004	.039±.004	.07±.004	<.004	.013±.004	.021±.004	100
Cd	.061±.01	.052±.01	.07±.01	<.01	.013±.01	.017±.01	.5
Co	.034±.01	.042±.01	.011±.01	<.01	<.01	.017±.01	
Cr	.013±.007	.010±.007	<.007	<.007	.009±.007	.013±.007	5
Cu	.09±.02	.11±.02	<.02	<.02	.03±.02	.05±.02	
Hg	<.02	<.02	<.02	<.02	<.02	<.02	.1
Ni	.06±.02	.05±.02	<.02	<.02	.02±.02	.04±.02	
Pb	<.03	.05±.03	<.03	<.03	<.03	.06±.03	5
Se	<.07	<.07	<.07	<.07	<.07	<.07	1
U	<.5	<.5	<.5	<.5	<.5	<.5	2
Zn	.194±.01	.267±.01	.211±.011	.024±.04	.033±.006	.047±.006	

TABLE 4.2(b)
LEACHATE EXTRACTION PROCEDURE
LEACHATE COMPOSITIONS. pH5, HAc; 22.5°C

	SOLUTION CONCENTRATIONS (μg/mL)						ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	RAW WASTE		WASTE CALCINED 1400°C		60% GLASS/40% WASTE		
	#1	#2	#1	#2	#1	#2	
Si	1.78±.09	1.92±.10	.26±.02	.43±.02	1.09±.05	0.8±.04	
Ca	36.2±1.8	35.2±1.8	.301±.15	.40±.02	1.77±.09	1.31±.07	
Na							
Al	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	
Fe	<.01	<.01	.039±.01	.032±.01	.063±.01	.094±.01	
Ti	<.02	<.02	<.02	<.02	<.02	<.02	
Ag	<.05	<.05	<.05	<.05	<.05	<.05	5
As	229±11	185±9	<.08	<.08	<.08	<.08	5
B	143±7	124±6	<.07	<.07	<.07	<.07	500
Ba	244±12	234±12	.069±.004	.091±.004	.025±.004	.028±.004	100
Cd	254±13	191±10	.059±.01	.087±.01	.058±.01	.044±.01	.5
Co	9.0±0.5	7.8±0.4	.022±.01	.046±.01	.066±.01	.051±.01	
Cr	<.007	<.007	<.007	<.007	<.007	<.007	5
Cu	0.09±.02	0.03±.02	.20±.02	.17±.02	.06±.02	.05±.02	
Hg	306±15	154±8	<.02	<.02	<.02	<.02	.1
Ni	0.28±.02	0.23±.02	.02±.02	.04±.02	.03±.02	.03±.02	
Pb	1.49±.07	1.12±.06	.05±.03	<.03	.04±.03	<.03	5
Se	49±2	26.0±1.3	<.07	<.07	<.07	<.07	1
U	0.7±0.5	0.6±0.5	<0.5	<0.5	<0.5	<0.5	2
Zn	357±18	301±15	.04±.006	.059±.006	.109±.006	.082±.006	

TABLE 4.2(b) Continued
LEACHATE EXTRACTION PROCEDURE
LEACHATE COMPOSITIONS. pH5, HAc; 22.5°C

	SOLUTION CONCENTRATIONS (µg/mL)						ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	60% GLASS (SS)/ 40% WASTE		90% GLASS/ 10% WASTE		90% GLASS (SS)/ 10% WASTE		
	#1	#2	#1	#2	#1	#2	
Si	0.41±.02	0.35±.02	.54±.03	1.57±.08	1.92±.10	1.03±.05	
Ca	.335±.017	.329±.016	.46±.02	1.65±.08	.60±.03	.88±.04	
Na							
Al	0.14±.11	<.11	.11±.11	.3±.11	<.11	<.11	
Fe	.06±.02	.04±.02	.02±.01	.06±.01	.025±.01	.109±.01	
Ti	<.02	<.02	<.02	<.02	<.02	<.02	
Ag	<.05	<.05	<.05	<.05	<.05	<.05	5
As	<.08	<.08	.08±.08	.13±.08	<.08	<.08	5
B	<.07	<.07	<.07	<.07	<.07	<.07	500
Ba	.021±.004	.020±.004	.008±.004	.021±.004	.008±.004	.009±.004	100
Cd	.03±.01	.029±.01	.012±.01	.019±.01	.013±.01	<.01	.5
Co	.027±.01	.026±.01	.012±.01	.02±.01	.013±.01	<.01	
Cr	<.007	<.007	<.007	<.007	<.007	<.007	5
Cu	.05±.02	.03±.02	<.02	.05±.02	<.02	<.02	
Hg	<.02	<.02	<.02	<.02	<.02	<.02	.1
Ni	.03±.02	<.02	<.02	.03±.02	<.02	<.02	
Pb	.03±.03	<.03	.03±.03	.06±.03	<.03	<.03	5
Se	<.07	<.07	<.07	<.07	<.07	<.07	1
U	<.5	<.5	<.5	<.5	<.5	<.5	2
Zn	.042±.006	.042±.006	.027±.006	.052±.006	.028±.006	.037±.006	

TABLE 4.2(c)
LEACHATE COMPOSITIONS RESULTING
FROM EXTRACTION IN DIW; 10°C

	SOLUTION CONCENTRATIONS (μg/mL)						ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	RAW WASTE		WASTE CALCINED 1400°C		60% GLASS/40% WASTE		
	#1	#2	#1	#2	#1	#2	
Si	1.26±.06	1.28±.06	.24±.02	.27±.02	.70±.03	.54±.02	
Ca	31.2±1.6	30.5±1.5	.26±.013	.358±.018	1.58±.05	.98±.05	
Na							
Al	<.11	<.11	<.11	<.11	<.11	<.11	
Fe	<.01	<.01	.012±.01	.014±.01	.089±.01	.035±.01	
Ti	<.02	<.02	<.02	<.02	<.02	<.02	
Ag	.034±.01	.035±.01	<.01	<.01	<.01	<.01	5
As	193±10	195±10	<.08	<.08	.08±.08	<.08	5
B	90±5	90±5	<.07	<.07	<.07	<.07	500
Ba	217±11	217±11	.029±.004	.048±.004	.01±.004	<.01	100
Cd	226±11	209±11	.027±.01	.033±.01	.041±.02	.011±.01	.5
Co	7.8±.4	7.5±.4	.02±.01	.032±.01	.045±.01	.027±.01	
Cr	<.007	<.007	<.007	<.007	.009±.007	<.007	5
Cu	.11±.02	.07±.02	.02±.02	<.02	.03±.02	<.02	
Hg	208±10	178±9	<.02	<.02	<.02	<.02	.1
Ni	.28±.02	.25±.02	.04±.02	<.02	.04±.02	<.02	
Pb	1.38±.07	1.31±.07	.03±.03	<.03	<.03	<.03	5
Se	48±2	45±2	<.07	<.07	<.07	<.07	1
U	<.5	<.5	<.5	<.5	<.5	<.5	2
Zn	309±15	297±15	.008±.006	.011±.006	.073±.006	.025±.006	

TABLE 4.2(c) Continued
LEACHATE COMPOSTIIONS RESULTING
FROM EXTRACTION IN DIW; 10°C

	SOLUTION CONCENTRATIONS (μg/mL)						ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	60% GLASS (SS)/ 40% WASTE		90% GLASS/ 10% WASTE		90% GLASS (SS)/ 10% WASTE		
	#1	#2	#1	#2	#1	#2	
Si	.69±.03	.42±.04	.64±.03	.92±.05	.74±.04 .52±.03	.94±.05 .68±.03	
Ca	.87±.04	.54±.03	.68±.03	1.19±.06			
Na							
Al	<.11	<.11	<.11	<.11	<.11	<.11	
Fe	.049±.01	.031±.01	.015±.01	.029±.01	.032±.01	.05±.01	
Ti	<.02	<.02	<.02	<.02	<.02	<.02	
Ag	<.01	<.01	<.01	<.01	<.01	<.01	5
As	<.08	<.08	<.08	<.08	<.08	<.08	5
B	<.01	<.07	<.07	<.07	<.07	<.07	500
Ba	.007±004	<.004	<.004	.011±.004	<.004	.006±.004	100
Cd	.020±.01	.014±.01	<.01	.012±.01	.018±.01	.014±.01	.5
Co	.018±.01	.011±.01	<.01	<.01	<.01	.018±.01	
Cr	<.007	<.007	<.007	<.007	<.007	<.007	5
Cu	<.02	<.02	<.02	<.02	<.02	.03±.02	
Hg	<.02	<.02	<.02	<.02	<.02	<.02	.1
Ni	.03±.02	<.02	<.02	<.02	.04±.02	.03±.02	
Pb	<.03	<.03	<.03	.03±.03	<.03	.04±.03	5
Se	<.07	<.07	<.07	<.07	<.07	<.07	1
U	<.5	<.5	<.5	<.5	<.5	<.5	2
Zn	.048±.006	.047±.006	.021±.006	.024±.006	.172±.009	.031±.006	

TABLE 4.2(d)
LEACHATE COMPOSITIONS RESULTING
FROM EXTRACTION IN DIW; 22.5°C

	SOLUTION CONCENTRATIONS (μg/mL)						ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	RAW WASTE		WASTE CALCINED 1400°C		60% GLASS/40% WASTE		
	#1	#2	#1	#2	#1	#2	
Si	2.10±.10	1.98±.10	.33±.02	.30±.02	.40±.02	.88±.02	
Ca	38.0±1.9	35.4±1.8	.381±.019	.368±.018	.42±.02	1.26±.06	
Na							
Al	<.11	<.11	<.11	<.11	<.11	<.11	
Fe	<.01	<.01	.091±.02	.17±.02	.027±.01	.063±.01	
Ti	<.02	<.02	<.02	<.02	<.02	<.02	
Ag	<.05	<.05	<.05	<.05	<.05	<.05	5
As	295±.15	279±14	<.08	<.08	<.08	<.08	5
B	113±6	107±5	<.07	<.07	<.07	<.07	500
Ba	265±13	244±12	.091±.004	.093±.004	.016±.004	.024±.004	100
Cd	327±16	309±15	.08±.01	.073±.01	.019±.01	.043±.01	.5
Co	13.8±.7	13.5±.7	.032±.01	.028±.01	.026±.01	.054±.01	
Cr	<.007	<.007	<.007	<.007	<.007	<.007	5
Cu	.32±.02	.31±02	.28±.02	.023±.02	.03±.02	.04±.02	
Hg	430±20	389±19	<.02	<.02	<.02	<.02	.1
Ni	.31±.02	.29±.02	.02±.02	<.02	.02±.02	.04±.02	
Pb	2.11±.11	2.12±.11	<.03	<.03	<.03	.03±.03	5
Se	76±4	69±3	<.07	<.07	<.07	<.07	1
U	1.2±.5	1.2±5	<.5	<.5	<.5	<.5	2
Zn	205±10	188±9	.053±.006	.051±.006	.038±.006	.082±.006	

TABLE 4.2(d) Continued
LEACHATE COMPOSITIONS RESULTING
FROM EXTRACTION IN DIW; 22.5°C

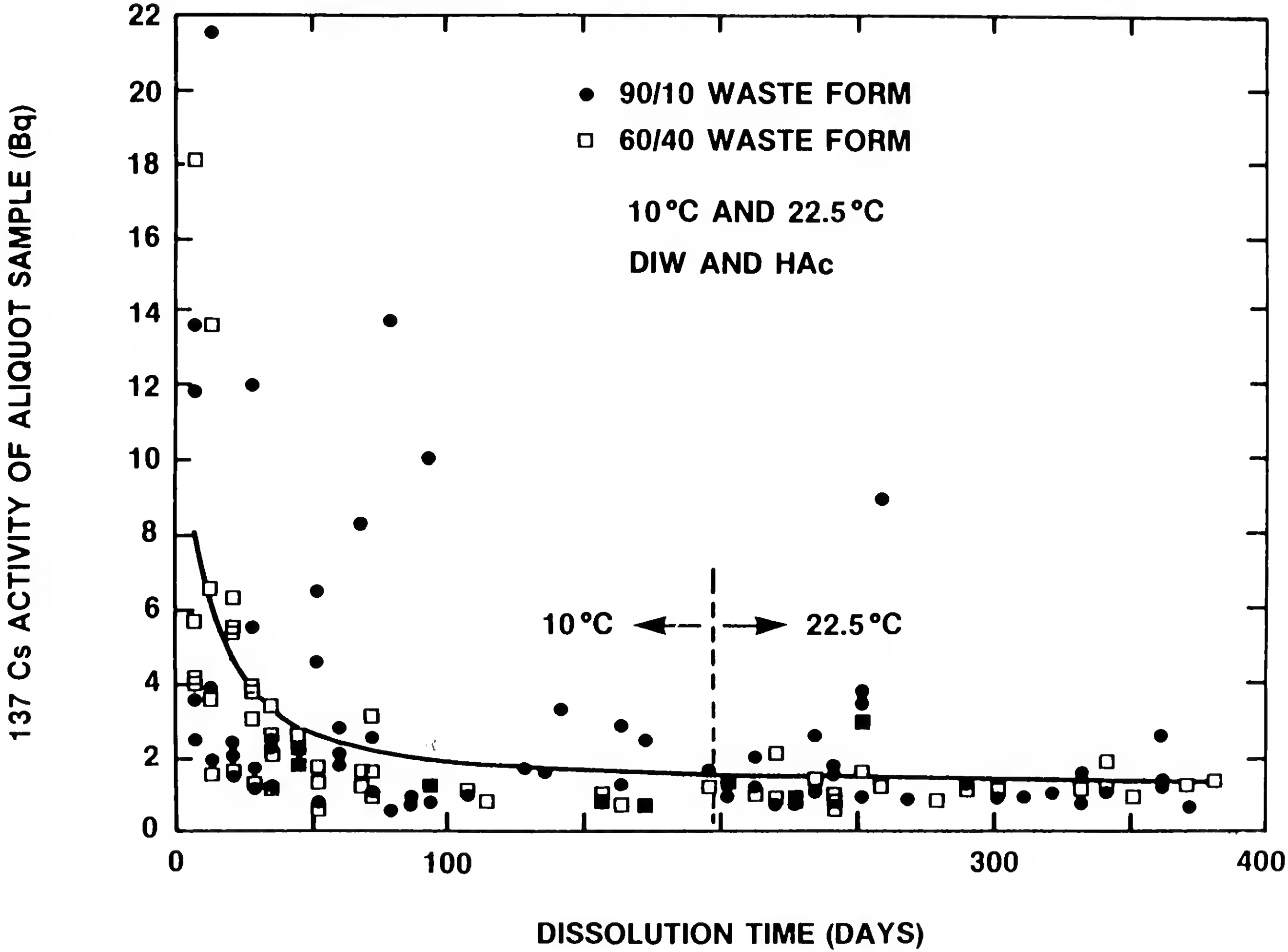
	SOLUTION CONCENTRATIONS (µg/mL)						ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	60% GLASS (SS)/ 40% WASTE		90% GLASS/ 10% WASTE		90% GLASS (SS)/ 10% WASTE		
	#1	#2	#1	#2	#1	#2	
Si	.53±.03	.67±.03	2.05±.1	2.38±.12	.65±.03	.83±.04	
Ca	.46±.02	.58±.03	1.84±.09	2.39±.12	.51±.03	.54±.03	
Na							
Al	<.11	<.11	.65±.11	.49±.11	.12±.11	<.11	
Fe	.035±.01	.048±.01	.165±.01	.57±03	.083±.01	.045±.01	
Ti	<.02	<.02	<.02	<.02	<.02	<.02	
Ag	<.05	<.05	<.05	<.05	<.05	<.05	5
As	<.08	<.08	.10±.08	<.08	<.08	<.08	5
B	<.07	<.07	<.07	<.07	<.07	<.07	500
Ba	.023±.004	.022±.004	.049±.004	.066±.004	.008±.004	.006±.004	100
Cd	.032±.01	.032±.01	.041±.01	.039±.01	.011±.01	.012±.01	.5
Co	.028±.01	.024±.01	.01±.01	.011±.01	.011±.01	<.01	
Cr	<.007	<.007	<.007	<.007	.026±.007	<.007	5
Cu	.04±.02	.04±.02	.04±.02	.04±.02	<.02	<.02	
Hg	<.02	<.02	<.02	<.02	<.02	<.02	.1
Ni	<.02	.03±.02	.02±.02	<.02	.03±.02	<.02	
Pb	<.03	<.03	.04±.03	<.03	<.03	<.03	5
Se	<.07	<.07	<.07	<.07	<.07	<.07	1
U	<.5	<.5	<.5	<.5	<.5	<.5	2
Zn	.052±.006	.071±.006	.088±.006	.094±.006	.023±.006	.031±.006	

TABLE 4.2.1

LEACHATE ANALYSIS FOR RAW WASTE, AND 60/40 WASTE FORM AFTER EXTENDED LEACHING

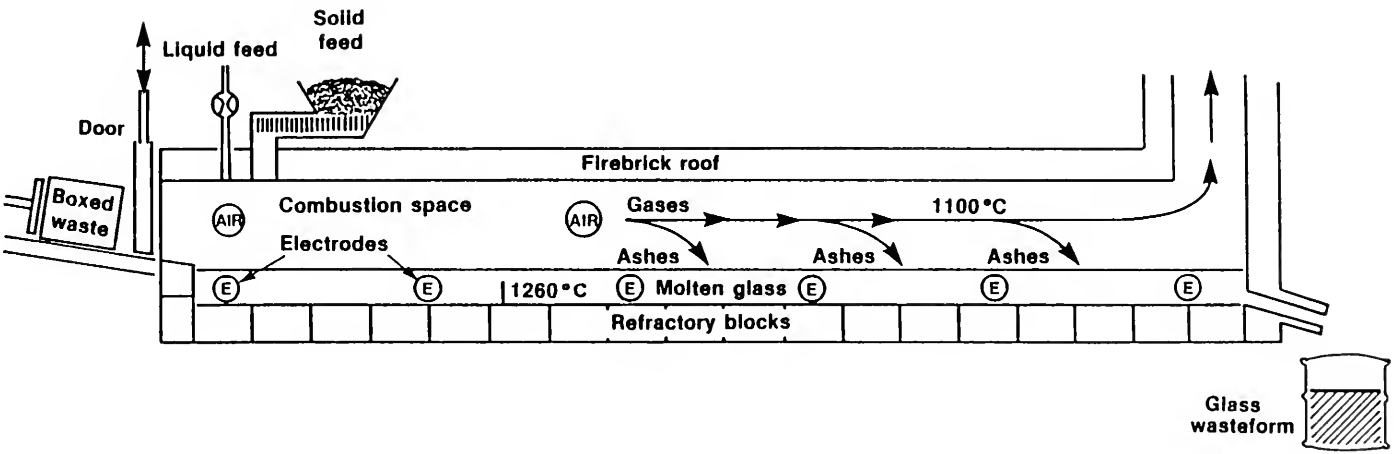
	SOLUTION CONCENTRATION (μg/mL)					ANALYTICAL SENSITIVITY	ONTARIO LEACHATE TOXIC CRITERIA (ug/ml)
	RAW WASTE		60% GLASS/40% WASTE				
	24 Hrs.	7 Days	24 Hrs.	7 Days	52Days		
Si	1.85±.10	3.37±.17	.95±.05	5.2±.3	9.6±02	±.02	
Ca	35.7±1.8	30.8±1.5	1.54±.08	2.90±.15	4.4±.2	±.002	
Na							
Al	<.11	<.11	<.11	.34±.11	<.11	±.11	
Fe	<.01	<.01	.079±.01	.176±.01	.53±.03	±.01	
Ti	<.02	<.02	<.02	<.02	<.02	±.02	
Ag	<.05	<.05	<.05	<.05	<.05	±.05	5
As	207±10	195±10	<.08	<.08	<.08	±.08	5
B	134±7	91±5	<.07	<.07	<.07	±.07	500
Ba	239	210±11	.026	.194	.283	±.004	100
Cd	223±12	167±8	.051	.173	.252	±.01	.5
Co	8.4±.5	8±.4	.059	.194	.266	±.01	-
Cr	<.007	<.007	<.007	.01	<.007	±.007	5
Cu	.26±.02	.05±.02	.06	.27	.48	±.02	.1
Hg	230±12	9.1±.5	<.02	<.02	<.02	±.02	.1
Ni	.25±.02	.27±.02	.03	.18	.22	±.02	
Pb	1.31±.07	1.04±.03	.04	.05	<.03	±.03	5
Se	38±1.8	35±1.7	<.07	<.07	<.07	±.07	1
U	.65±.5	<.5	<.5	<.5	<.5	±.5	2
Zn	329±17	261±13	.096	.258	.375	±.006	

FIGURE 4.1.3.1: SYNTHESIS OF ALL NON-ZERO DATA POINTS OBTAINED DURING LEACHING OF RADIOACTIVITY-SPIKED 90/10 AND 60/40 WASTE FORMS, IN DIW AND HAc, AT 10°C AND 25°C



90/10 WASTE FORM
60/40 WASTE FORM
10°C AND 22.5°C
DIW AND HAc
10°C
22.5°C
137 Cs ACTIVITY OF ALIQUOT SAMPLE (Bq)
DISSOLUTION TIME (DAYS)
0
2
4
6
8
10
12
14
16
18
20
22
100
300
400

FIGURE 6.2: DIAGRAM OF A JOULE-MELTING INCINERATOR (AFTER PENBERTHY)


Solid feed
Liquid feed
Door
Boxed waste
Firebrick roof
AIR
Combustion space
AIR
Gases
1100 °C
Electrodes
Ashes
Ashes
Ashes
E
E
1260 °C
E
Molten glass
E
E
E
Refractory blocks
Glass wasteform